JANUARY

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

Structures Forming the Oral Cavity—*Logan*
Operative Procedure and Education—*Rowe*
Dental Porcelain—*Clark*
Labial Arches in Malocclusion—*Ford*
Conservation of the Edentulous Process—*Page*
Mercurial Stomatitis—McGeorge
Treatment of Root Canals—*Girardot*
Cooperation of Physician and Dentist—*McLean*
Reaction of Tissues Supporting Dentures—*Pendleton and Glupker*
Establishing Centric Relation—*Furnas*
Routine Radiodontic Examination—*Simpson*
Rat Susceptibility to Caries—*Rosebury et al.*
Diet and Dental Caries—*Bunting*

EDITORIALS

Conference on Social Security—Response from Seals—Depression and Its C[illegible]—Committees

COUNCIL ON DE[illegible] THERAPEUTICS

Calox Tooth Powde[illegible] Not Ad[illegible]ible to A.D.R.

BUREAU O[illegible] PUBLIC RELATIO[illegible]

House Tha[illegible]nacks Built—De[illegible]

Dent[illegible] Caries—

D[illegible] *Boyd*

FIFTY CENTS

CONTENTS

Florestan Aguilar, M.D., D.D.S., LL.D., F.A.C.S. ..... Frontispiece

ORIGINAL COMMUNICATIONS

A Histologic Study of the Anatomic Structures Forming the Oral Cavity.
By William H. G. Logan, M.S., M.D., D.D.S., F.A.C.S. 3
Present Trends in Operative Procedure and Their Possible Influence on Dental Education.
By Arthur Taylor Rowe, D.D.S., F.A.C.D. 30
Manipulation of Dental Porcelain.
By E. Bruce Clark, D.D.S. 33
Plain and High Labial Arches as Corrective Agents in the Treatment of Malocclusion.
By James W. Ford, D.D.S. 40
Conservation of the Edentulous Alveolar Process.
By Melvin E. Page, D.D.S. 52
Mercurial Stomatitis.
By J. R. McGeorge, D.D.S. 60
Leukoplakia.
By Homer C. Vaughan, D.D.S. 65
Therapeutic Treatment of Root Canals.
By Raymond L. Girardot, D.D.S. 66
Cooperation of Physician and Dentist in Prevention and Early Recognition of Disease.
By R. Gordon McLean, D.D.S., F.A.C.D. 72
Research on the Reaction of Tissues Supporting Full Dentures.
By Elbert C. Pendleton, D.D.S., and Henry Glupker D.D.S. 76
Problem of Establishing Centric Relation: Its Importance and Solution.
By I. L. Furnas, D.D.S. 89
The Value of Routine Radiodontic Examination.
By Clarence O. Simpson, M.D., D.D.S., F.A.C.D. 95
Studies in the Rat of Susceptibility to Dental Caries: A Review of Four Years of Research.
By Theodor Rosebury, D.D.S.; Maxwell Karshan, Ph.D., and Genevieve Foley, M.A. 98
Diet and Dental Caries.
By Russell W. Bunting, D.D.Sc. 114
Iodine Dermatitis—Report of Case.
By Karlton K. Priest, D.D.S. 122

EDITORIAL DEPARTMENT

Conference on Social Security.—The Response from the Seals.—A Few Reflections on the Depression and Its Cure.—A New Service.—The Dental Gazette: Official Organ of the Public Dental Service Organization.—Committees.—The Mail Order Dental Racket.—The Death of Dr. Florestan Aguilar. 123-138

Practice in Paragraphs 138

COUNCIL ON DENTAL THERAPEUTICS

Calox Tooth Powder—Not Admissible to Accepted Dental Remedies 140
More Misbranded Dental Nostrums 143
One View of the Council 148

BUREAU OF PUBLIC RELATIONS

The House That Shacks Built.
By G. G. Bell, D.D.S. 149
The Control and Arrest of Dental Caries: Institutional Study.
By C. L. Drain, D.D.S., and J. D. Boyd, M.D. 155
A Constructive Program for Dental Health 158
Dental Health Posters 161

CURRENT LITERATURE

Abstracts 164

NEWS

State, General and Foreign News 170

MISCELLANY

Book Review 175
Correspondence 176
Resolution Regarding Mail-Order Orthodontia Laboratories 176

Directory of State Society Officers and Dates of Meetings, 1935 177

Announcements 185

THE LIBRARY BUREAU

Are You Prepared to Discuss Socialized Dentistry and Medicine? 187

ADVERTISEMENTS

Index to Advertisements A-35
Classified Section A-26

The Journal of the American Dental Association, Vol. XXII, No. 1. Published by the American Dental Association, 212 East Superior Street, Chicago, Ill. Yearly subscription $3.50. Entered as second-class matter, May 1, 1928, at the postoffice at Chicago, Ill., under the act of Aug. 24, 1912. Published monthly.

Copyright, 1935, by the American Dental Association.

FLORESTAN AGUILAR, M.D., D.D.S., LL.D., F.A.C.S.
Died, Madrid, Spain, Nov. 29, 1934

THE JOURNAL
of the AMERICAN DENTAL ASSOCIATION

Vol. 22 JANUARY, 1935 No. 1

Original Communications

A HISTOLOGIC STUDY OF THE ANATOMIC STRUCTURES FORMING THE ORAL CAVITY*

By WILLIAM H. G. LOGAN, M.S., M.D., D.D.S., F.A.C.S., Chicago, Ill.

ANATOMY is the foundation of medical and surgical science. Without a thorough knowledge of the structures of the human body and their topographic and functional relationship, any logical or successful therapy is impossible. The minute anatomy of infant jaws, teeth and associated oral structures was chosen as the basis of this presentation because of the realization that such knowledge would be of inestimable value to all those dealing with children, whether in the study of the child's growth and development, or in the field of pediatrics, dietary sciences, dentistry and oral or maxillofacial surgery.

Before entering into a description of the technic of this investigation and of the actual findings, it is held advisable to point out the need for additional study in this field. Although the consensus of opinion probably is that previous investigators in anatomy and histology have already produced sufficient information to meet the requirements of all workers on this subject, a survey of the literature reveals that this earlier knowledge is such that it is difficult, and, in certain instances, impossible, to comprehend the topography of the oral structures from it. The material found in present-day textbooks may be grouped loosely into four major divisions: (1) dry bone specimens (skulls); (2) anatomic specimens; (3) frozen sections through heads of infants, and (4) histologic sections of animal material. None of these groups can give adequate information to the student regarding the structure of infant jaws and teeth and associated oral parts.

In dry skulls, the soft tissues which ordinarily support the developing teeth

*From the Research Department of the Chicago College of Dental Surgery, Dental Department of Loyola University.

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 9, 1933.

in infancy are lost, and this invariably results in a displacement or loss of the tooth germs. The main objection to such bone specimens lies in the difficulty of studying all of the early stages of tooth and jaw development because the delicate structures of the forming germs undergo decomposition, leaving only those germs the crowns of which were fairly well formed and calcified at the time of death.

There are similar objections to the second group, the anatomic specimens. At birth, or at the age of a few months, most structures attached to the maxilla or mandible are not sufficiently differentiated to be good subjects for anatomic dissection. One of the most important investigations of this type was carried forward by Broomell and Fischelis[1] and although these authors made instructive dissections, nevertheless they found it necessary to separate completely the soft tissues from the surrounding and underlying bone, thus causing preparatory distortion and displacement, which, to a certain degree, detract from the value of these specimens.

In frozen sections through the heads of infants, the various structures and organs of the oral cavity and jaws can be studied in their undisturbed relationship. Such sections have been published by Blair[2] and Stone.[3] The difficulty encountered in the use of such sections is that, in early infancy, many of the dental structures, particularly the permanent teeth, are so small that they cannot be

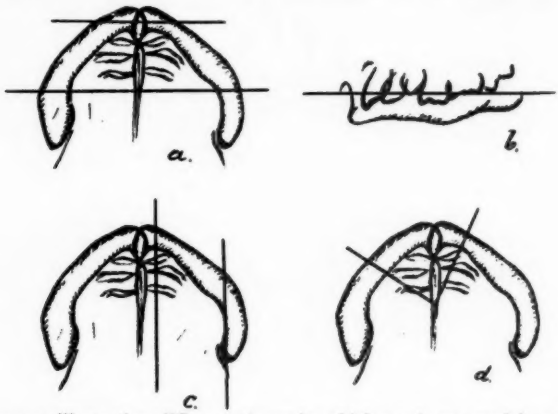


Fig. 1.—Diagrams illustrating different planes in which specimens used in study have been sectioned. *a*, **occlusal view of infant's upper jaw, showing the direction of frontal sections. (Compare Fig. 4.)** *b*, **lateral view of infant's maxilla, showing position of tooth germs and direction of horizontal sections. (Compare Fig. 13.)** *c*, **occlusal view of infant's upper jaw, showing direction of sagittal sections through median line and through lateral portion of maxilla. (Compare Fig. 22.)** *d*, **occlusal view of infant's upper jaw, showing direction of radial sections through anterior teeth. (Compare Fig. 8.)**

1. Broomell, I. N., and Fischelis, P.: Anatomy and Histology of Mouth and Teeth, Philadelphia: P. Blakiston's Son & Co., 1917, p. 424.

2. Blair, V. P.: Surgery and Diseases of Mouth and Jaws, St. Louis: C. V. Mosby Co., 1917, p. 187.

3. Stone, in Brophy, T. W.: Oral Surgery, Philadelphia: P. Blakiston's Son & Co., 1918, p. 593.

recognized or studied understandingly in a thick frozen section. Important tissue changes can be investigated only in stained microtome sections that are thin enough to permit of microscopic examination.

Histologic sections through the jaws of young animals have a certain value as research material on the development and shedding of teeth. However, there are such fundamental differences in type, size and form of the teeth, in the process of shedding and in the rate of development between man and animals that animal specimens at best can give only a general idea of human structures, and conclusions as to analogous processes of development and structures in man can be drawn only with the broadest reservations.

From the foregoing, it appears evident that a definite need existed for a study of the postnatal development of human jaws, teeth and associated oral and facial structures, based upon a method of sectioning that would not distort or change the topography in any way or cause the loss or destruction of any tissues, but would make it possible to study even the earliest and most minute tissue changes *in situ*. This method was the study of histologic sections through human jaws and their adjacent structures at different ages. For this purpose, twenty-seven human heads were procured, ranging in age from birth to 15 years (twenty-one were 2 years or under). All of these structures were removed from the bodies within a few hours after death, fixed in formalin and alcohol, decalcified, embedded in celloidin and sectioned in series. The histologic technic, that de-

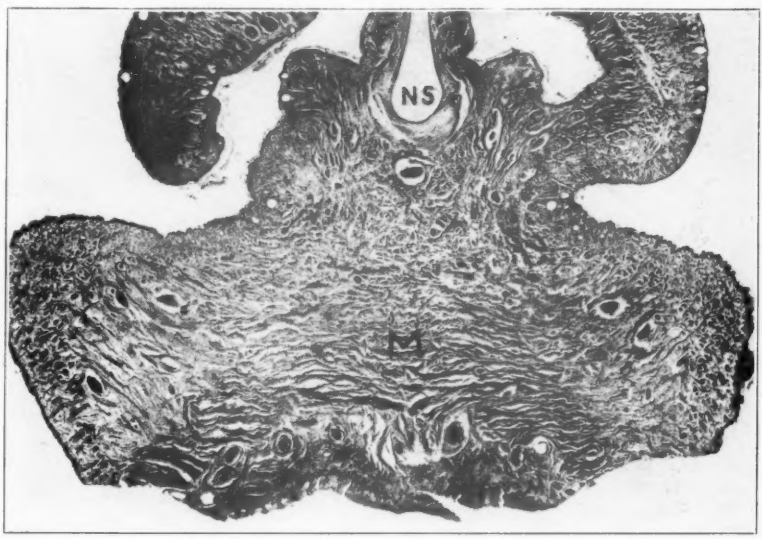


Fig. 2.—Frontal section through nose and upper lip of infant 2 weeks of age. On the left side, the section passes through the opening of the nostril. On the right side, it runs through the tissues posterior to the nasal aperture. *M*, horizontal bundles of muscle fibers passing across the median line (orbicularis oris muscle). *NS*, cartilaginous nasal septum.

veloped by Professor Gottlieb and his associates of Vienna, has been described in a previous report.[4] In this presentation, a few diagrams are used to illustrate and clarify certain terms that are employed to indicate the direction in which the material was sectioned.

An infant's upper jaw at birth represents a rather complicated structure, containing, within a limited area, twenty-four deciduous and permanent tooth germs in an extremely crowded arrangement. As a result, a single histologic section through such a jaw would present a puzzling arrangement of germs lying very close to each other and frequently overlapping. Considerable experience with sections of this type is necessary to evaluate correctly the microscopic findings, and even then it is essential to compare serial sections of a number of specimens of the same age to interpret the findings properly: hence, the need for sectioning all structures in certain definite planes and adopting a suitable nomenclature for each direction.

SECTIONING IN FOUR PLANES

This report is based upon findings gained by sectioning human jaws or parts of such jaws and associated tissues in at least four planes, which are enumerated in the order in which they will be discussed (Figs. 1 *a, b, c, d*): frontal, horizontal, sagittal and radial sections.

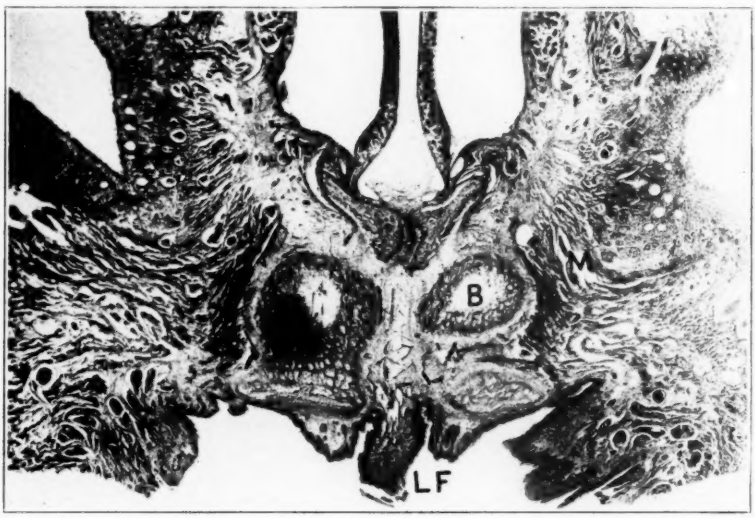


Fig. 3.—Frontal section through same specimen as in Figure 2, farther posteriorly. *B*, bony prominence overlying germs of deciduous central incisors. *LF*, labial frenum. *M*, muscle bundles attached to bone in area distad from central incisors (deep portion of orbicularis oris muscle, incisivus labii superioris muscle, and alar portion of nasalis muscle).

Frontal Sections.—The term "sectioned in a frontal plane," when applied to sections through a human jaw, indicates that the serial sections begin in a frontal plane with the tip of the nose,

4. Logan, W. H. G., and Kronfeld, Rudolf: Development of Human Jaws and Surrounding Structures from Birth to Age of Fifteen Years, J.A.D.A., 20:393 (March) 1933.

then proceed backward through the nose, anterior and posterior teeth, orbit, maxillary sinus and hard and soft palate. It follows that in sectioning a jaw in a frontal plane, the sections through the anterior teeth, incisors and cuspids, are mesiodistal sections, and those through the teeth posterior to the cuspids are buccolingual sections (Fig. 1 *a*).

Horizontal Sections.—In sectioning an infant's upper jaw in a horizontal plane, the first sections are usually obtained from the fibrous tissue at the maxillary ridge. Then, as the serial sections proceed upward, they include all of the tooth germs or teeth in sections approximately at right angles to the long axis of the teeth until they pass beyond the root ends and proceed upward in the direction of the maxillary sinus and orbit (Fig. 1 *b*).

Sagittal Sections.—Sections prepared in a sagittal plane run in an anteroposterior direction through the head and jaw. If the process of sectioning is begun in the median line, the first sections will run between the central incisors and through the nasal septum. Proceeding laterally, the sections will run through the incisor region, and then in an anteroposterior direction through the lateral portion of the jaw, including all teeth from the cuspid to the last molar. Obviously, sagittal sections will have to be considered labiolingual sections for the central incisors, and mesiodistal sections for the cuspids and the teeth distad from them (Fig. 1 *c*).

Fig. 4.—Frontal section through same specimen as in Figure 3, farther posteriorly. *I*, germs of deciduous central incisors. *M*, muscle bundles of deep portion of orbicularis oris muscle, incisivus labii superioris muscle and alar portion of nasalis muscle, attached to alveolar bone in area of lateral incisor. *NS*, nasal septum.

Radial Sections.—There is still another important plane in which sections may be cut through jaws and associated structures, particularly through the area of the lateral incisor, cuspid and first bicuspid. These may be called radial sec-

tions because they run parallel to the radii of a hypothetic center of the upper or lower jaw (Fig. 1 *d*), but a more common nomenclature is labiolingual or buccolingual sections. Their importance lies in the fact that they show the relative position of permanent and deciduous germs better than any other section, especially in cases in which the permanent tooth germ lies linguad from the corresponding deciduous germ. They also reveal the attachment of the facial muscles to the underlying bone (Fig. 1 *d*).

Technical limitations make it impossible to show even a small number of the approximately 10,000 histologic sections through infant jaws that have been prepared during the past four years in the Research Department of the Dental School of Loyola University, by Maurine Willman, under the supervision of Rudolf Kronfeld, to whom I am greatly indebted for his assistance in the interpretation of the histologic findings reported in this article. Therefore, only a few selected sections will be reproduced, and their application to various problems in dentistry and surgery will be briefly mentioned.

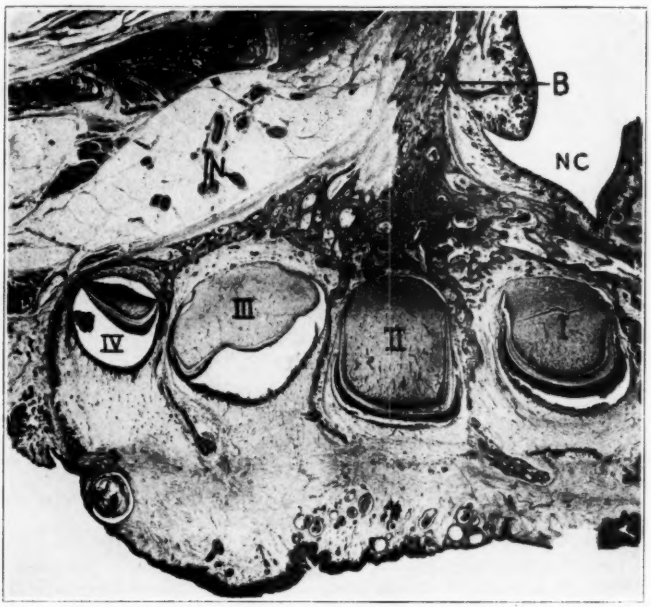


Fig. 5.—Frontal section through anterior portion of one half of upper jaw of child 2 months of age. *I*, deciduous central incisor. *II*, deciduous lateral incisor. *III*, deciduous cuspid. *IV*, first deciduous molar. *NC*, nasal cavity. *IN*, infra-orbital nerves and vessels. *B*, ridge of compact bone above deciduous lateral incisor germ, forming lateral wall of nasal aperture.

FRONTAL SECTIONS

The first three photomicrographs were made from a series of about 480 sections cut in a frontal plane through the nose, upper lip and jaw, and terminating with the tip of the uvula, of a child of 2 weeks. The first section (Fig. 2) runs

through the nose and central portion of the lip. On the left side, the section passes through the aperture of the nostril; on the right side, owing to a slight asymmetry of the specimen, the section runs through the nasal tissues behind the right nostril. The most significant feature in this specimen is not the course at this level, but the degree of development of the muscle fibers in the lip at this age. Bundles of muscle fibers run horizontally from the cuspid area on one side across the median line to the cuspid area on the opposite side, and form part of the orbicularis oris muscle. The anterior or superficial portion of this muscle, located directly beneath the epidermis and adipose tissue of the lips, encircles the oral opening and functions as a true sphincter muscle. The degree of development of the encircling muscular fibers of the orbicularis oris muscle at birth demands careful consideration in determining the appropriate direction of incisions to repair a congenital cleft of the lip. This finding has special significance because of the claim frequently made by outstanding plastic surgeons that the fibers of the orbicularis oris muscle have not developed in the early weeks and months of infancy to such a degree as to make them an important factor in deciding on a line of incision to repair a cleft lip.

The direction of the fibers, in part, change when sections are made through a more posterior plane of the same specimen (Fig. 3). This section runs through the anterior portion of the two symmetrical bony elevations that are found on the anterior plane of the upper jaw and are caused by a projection of the bony crypts of the deciduous central incisors. In this level, the fiber bundles originate from the bone of the maxillae distad from the deciduous central in-

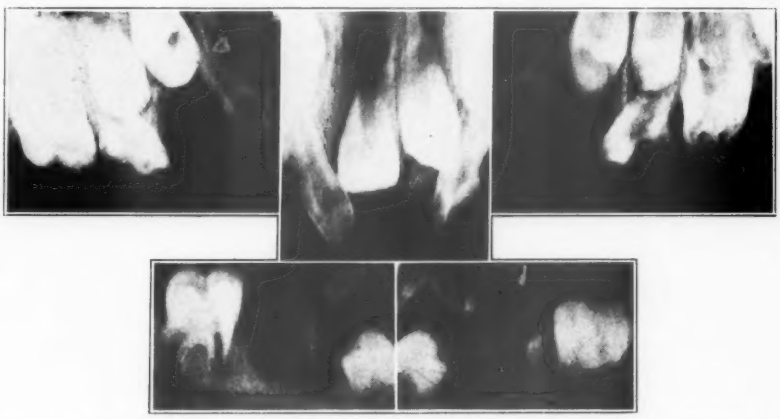


Fig. 6.—Teeth of boy 7 years of age. During the third month of life, an operation for closure of a congenital complete bilateral cleft palate and cleft lip had been performed by the author, using Brophy's method of passing silver wires through the jaw. These operations resulted in a complete closure of the lip, alveolar process and hard palate. In the upper jaw, the germs of the permanent lateral incisors are missing. The germs of all four upper bicuspids are apparently normally formed and in proper place. In the lower jaw, the germs of the lower second bicuspids are congenitally missing.

cisors. Some of the muscle bundles are markedly deflected upward and become continuous with the muscles that constrict and dilate the ala of the nose.

This deep attachment of the muscles of the upper lip is still more marked in the area laterad from the deciduous central incisor, as shown in Figure 4, a frontal section that runs through both central incisor germs. The broad attachment of the deep muscle fibers of the upper lip to the anterior plane of the maxilla in the area between the median line of the deciduous central incisor and cuspid is also very plainly visible in horizontal sections through the upper jaw and lip (Fig. 19) and in sagittal sections (Figs. 20, 24).

What is the clinical significance of this deep attachment of the musculature of the lip to the bone in the area of the lateral incisor? To answer this question, it is necessary to consider briefly the anatomic defect in cases of complete congenital cleft of the upper jaw and lip. In practically all cases, the line of cleft

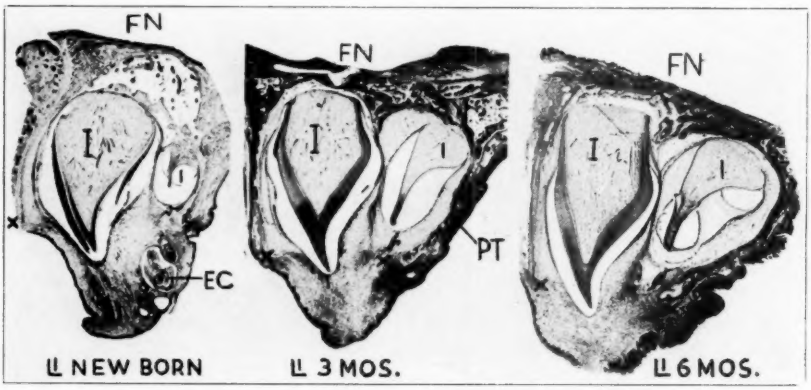


Fig. 7.—Topographic relation of germ of upper permanent central incisor to surrounding structures at various ages; labiolingual (radial) sections through deciduous and permanent central incisor. Left: From new born infant. The germ of the permanent central incisor *(1)* lies on the lingual side of the crown of the deciduous central incisor *(I)*. There is no calcification of the permanent germ. The labial and lingual bone plate end occlusally at *x*. On both the labial and the lingual side, the bone overlying the germs is very thin and consists mostly of soft uncalcified bone matrix. *EC*, epithelial cysts derived from dental lamina. *FN*, floor of nasal cavity.

Center: From infant aged 3 months. Beginning formation of root of deciduous incisor; marked increase in size of germ of permanent central incisor *(1)*; earliest evidence of calcification (enamel and dentin formation) at incisal edge. The labial and lingual bone plate end at *x*. On the lingual side, the bone consists of small islands of uncalcified matrix in its lower portion. The entire bony crypt is very delicate, the more massive bone being confined to the palatine process of the maxilla. *PT*, thin layer of palatine soft tissue, overlying lingual bone plate. *FN*, floor of nasal cavity.

Right: From infant aged 6 months. Advanced formation of root of deciduous central incisor; formation of enamel and dentin at incisal edge of permanent central incisor *(1)*. The increase in size of the permanent germ causes a decrease in the thickness of the lingual bone plate, *AB*. The bone on the lingual side of the permanent germ is very weak and covered only by a thin layer of palatine soft tissue. *x*, occlusal end of bone of labial and lingual side. *FN*, floor of nasal cavity.

divides the jaw at some point between the central incisor and the cuspid. The lateral incisor, if present, may be found on either fragment of the upper jaw, and when erupted it is often found either distad from the central incisor or high up in the cleft. It is evident that a cleft through the lateral incisor field must interfere, for the major part, with the deep attachment of the muscles of the upper lip to the bone in this particular region, and this accounts in part for the difficulties often encountered in surgical attempts to unite the lip over a bone cleft when there has not been a previous reduction of the cleft through the maxillary ridge.

Even in those operations for a com-

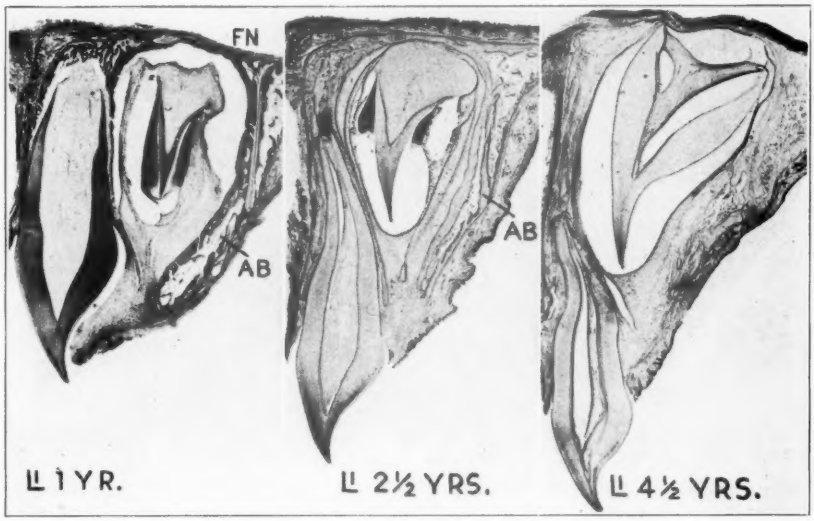


Fig. 8.—Left: From infant aged 1 year. The deciduous central incisor has erupted. Its root is almost completed. The germ of the permanent central incisor lies on the lingual side of the root of the deciduous incisor directly beneath the floor of the nasal cavity, *FN*. A well-developed, strong bone plate *(AB)* is present on the lingual side of the permanent germ.

Center: From infant aged 2½ years. The root of the deciduous central incisor is fully formed. The germ of the permanent central incisor lies on the lingual and apical side of the root of the deciduous incisor, beneath the floor of the nasal cavity. About one-third of the crown of the permanent tooth is formed. Well-developed, strong bone plate *(AB)* is present on the lingual and occlusal side of the permanent germ. There are thick palatine soft tissues with marked rugae palatinae.

Right: From infant aged 4½ years. The permanent crown is fully formed and is located above and slightly toward the lingual side of the root of the deciduous incisor. There is beginning resorption of the deciduous root. A strong bone plate with an outer and inner compact layer and cancellous bone is present between the permanent germ and the palatal soft tissues.

(A comparison of the three specimens in Figure 7 [birth to 6 months] shows that, as the germ of the permanent incisor is rapidly becoming larger, the distance between the germ and the superficial lingual tissues is reduced. The resulting thinness of the lingual periosteum and mucosa makes it very difficult, at this age, to prevent the destruction or detachment of the soft, uncalcified lingual bone plate during surgical detachment of the lingual soft tissues with knife or periosteotome.)

plete unilateral cleft in which the first surgical step has been the closure of the lip, and no attempt has previously been made to reduce the bony cleft by the direct application of force, it is advisable to provide for an increased area for attachment of these deep muscle fibers of the lip and ala to the underlying divided jaw. This can often be accomplished by exposing the periosteum in the general field of the central and lateral incisor from the median line to the border of the cleft on the long fragment, and from the general field of the cuspid to the border of the cleft on the short fragment; the lower border of this exposure to be on a line with the uniform attachment of the lip under the normal nostril.

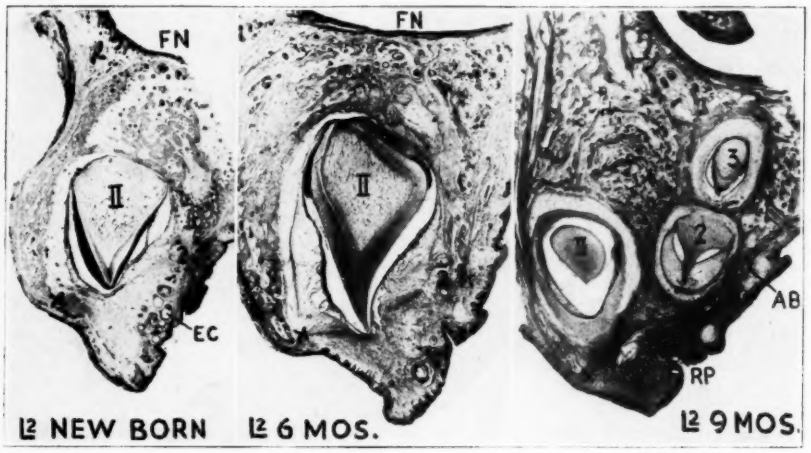


Fig. 9.—Topographic relation of germ of upper permanent lateral incisor to surrounding structures at various ages; labiolingual (radial) sections through deciduous and permanent lateral incisors.

Left: From new born infant. The germ of the permanent lateral incisor *(2)*, which lies on the lingual side of the crown of the deciduous lateral incisor *(II)*, consists of a small epithelial bud without any differentiation. No bone is present on the lingual or on the occlusal side of the permanent lateral incisor: the germ is embedded in the fibrous connective tissue on the lingual side of the deciduous tooth. *EC*, epithelial cysts derived from the dental lamina. *x*, occlusal end of bone on labial and lingual side. *FN*, floor of nasal cavity.

Center: From infant aged 6 months. The germ of the permanent lateral incisor *(2)* consists of a small epithelial bud without any differentiation, located on the lingual side of the deciduous lateral incisor *(II)*, within the lingual bone crest. The germ is embedded in fibrous connective tissue. The bone, on its lingual side, consists mostly of small islands of uncalcified bone matrix, ending occlusally at *x*. *FN*, floor of nasal cavity.

Right: From infant aged 9 months. The germ of the permanent incisor *(2)*, which is differentiated into enamel organ and pulp, is located on the lingual and distal side of the root of the deciduous lateral incisor, between the latter and the deciduous cuspid. (Compare also Fig. 18.) The very delicate lingual bone plate, *AB*, overlying the germ is slightly elevated over the level of the surrounding lingual alveolar process. The occlusal end of the bone is marked *x*. It should be noted that, owing to the increase in the size of the germ, the latter has come closer to the lingual superficial tissues than in the earlier stages of development. *II*, distal end of crown of deciduous lateral incisor. *3*, mesial end of germ of permanent cuspid. *RP*, rugae palatinae.

By bringing this incised surface in direct contact with a corresponding incised surface on the under surface of the cleft lip (muscle fibers) on mesial and distal fragments, a desirable surgical situation is established. A more normal appearance and function of the muscles under discussion can undoubtedly be expected when a full bone foundation is first established through the line of the cleft

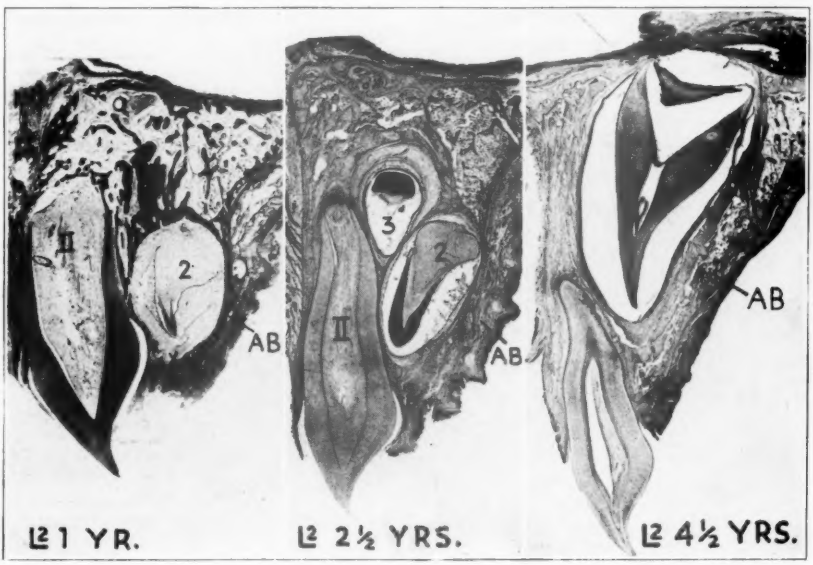


Fig. 10.—Left: From infant aged 1 year. The deciduous lateral incisor has erupted. The germ of the permanent lateral incisor lies on the lingual side of the root and the crown of the deciduous tooth. There is the earliest evidence of calcification (enamel and dentin formation) at the incisal edge of the permanent lateral incisor. The presence of the permanent germ causes a definite prominence of the bone on the lingual side of the maxillary ridge. The bone, *AB*, overlying the lingual side of the germ, is extremely thin. It ends occlusally at *x*.

Center: From infant aged 2½ years. The root of the deciduous lateral incisor is almost fully formed. The germ of the permanent lateral incisor lies on the lingual side of the root of the deciduous incisor. Enamel and dentin are formed at the incisal edge. There is beginning formation of a definite bone plate, *AB*, on the lingual side of the permanent germ.

Right: From infant aged 4½ years. The permanent crown, which is almost fully formed, is located above and slightly toward the lingual side of the root of the deciduous incisor, beneath the floor of the nasal cavity. The well-developed bone plate *AB* is on the lingual and occlusal side of the deciduous germ.

(A comparison of Figure 9 [lateral incisor] with Figure 7 [central incisor] shows that the lateral incisor becomes encased by bone much later than the central incisor. Although the latter is protected by a definite bone plate on the lingual side at the age of 1 year, such a bone development is not found over the lateral incisor until the third year of life. During the first year of life, the germ of the permanent lateral incisor is located in the fibrous connective tissue on the lingual side of the deciduous crown, without any bony protection. During the second year, there is a very thin bone plate present on the lingual and partly on the occlusal side of the germ, but owing to the fact that this bone is barely calcified, it can be expected to present clinically the consistency of cartilage during any surgical interference with the palatal tissues.)

for the support and attachment of the deep fibers that radiate from the orbicularis oris muscle to the bone as well as those that intermingle with the dilators and constrictors of the ala nasi on the defective side.

The position of the lateral incisor in relation to the nasal aperture can be clearly seen in a frontal section through the anterior teeth at the age of 2 months (Fig. 5). The line of a cleft in this area would run from the lower mesial and external angles of the nasal aperture in a vertical direction above the root end of the deciduous lateral incisor. In using the direct application of force, either by an anterior single wire, or by the Brophy or the Brophy-Logan technic, the anterior wire should pass through this bony mass which extends downward from the outer wall of the nasal aperture.

The bone in this general field is more compact than can be found in any other area mesiad from the second deciduous molar, thus affording the firmest resist-

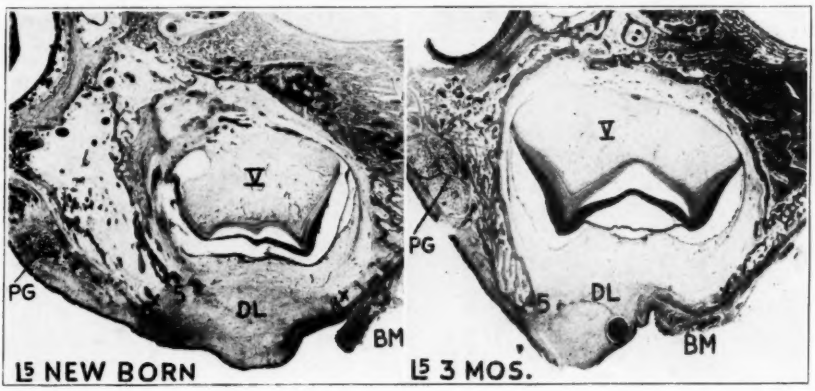


Fig. 11.—Topographic relation of germ of upper second bicuspid to surrounding structures at various ages; frontal (buccolingual) sections through second deciduous molar and bicuspid.

Left: From new born infant. The germ of the second bicuspid *(5)* consists of a small epithelial bud without differentiation, located on the occlusal side of the crown of the second deciduous molar, *V*, opposite the mesiolingual cusp of the molar. It is embedded in fibrous connective tissue, without any bone on either lingual or occlusal side. *x*, occlusal end of labial and lingual bone. *DL*, dental lamina. *PG*, palatine glands. *BM*, buccinator muscle.

Right: From infant aged 3 months. The germ of the second bicuspid *(5)* is located on the occlusal side of the deciduous molar near the lingual bone crest, within the fibrous connective tissue of the maxillary ridge. The bone on the lingual side of the deciduous molar consists of very delicate, partly calcified bony spicules. *x*, occlusal end of labial and lingual bone. *DL*, dental lamina. *PG*, palatine glands. *BM*, buccinator muscle.

downward and outward between central incisor and cuspid, as the position of the lateral incisor is not necessarily constant in either fragment in cleft palate cases. In this specimen, special attention should be given to the presence of a very pronounced ridge of compact bone extending

ance for any wire or suture material that a surgeon may feel should be passed anteriorly from the cuspids.

Frontal sections farther distad show the topography of the jaw in the bicuspid region. This area is of great practical interest since, in all operations for the sur-

gical correction of congenital cleft of the palate during the first months of life, the investing tissues in the region of the upper deciduous molars may be destroyed or carried from their normal position (1) by incisions in the field of these tooth germs; (2) by detaching the periosteum from the occlusal surface of the maxillary ridge, and (3) by the passing of needles or wires near the occlusal surface of the maxillary ridge in this immediate field. Therefore, regardless of the type of surgical technic, a thorough knowledge of the minute anatomy of this region is of great importance.

One of the principal questions that arise in connection with surgical operations on infant jaws is the location of the germs of the permanent teeth. Heretofore, what has been known about the position of these permanent germs in early infancy? For instance, before the first sections of this group were studied in June, 1929, were there available any authoritative data about the exact location of the germs of the upper bicuspids from birth to 2 years of age, and how these germs might be influenced or injured by certain types of operation in this region? These questions must be answered in the negative. The few authors who attempted to illustrate the topography of the deciduous molar region by means of dry bone specimens (Cryer[5]), by diagrams (Brophy[6]; Treves[7]) and by reproductions of frozen sections (Blair[2];

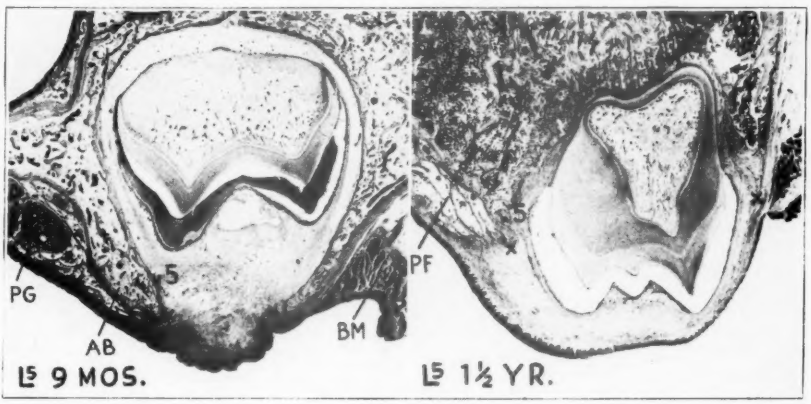


Fig. 12.—Left: From infant aged 9 months. The germ of the second bicuspid *(5)* is located on the occlusal and lingual side of the crown of the second deciduous molar, slightly above the level of the lingual bone crest, *AB*. *x*, occlusal end of labial and lingual bone. No bone is present on the occlusal side of the permanent germ. *PG*, palatine glands. *BM*, buccinator muscle.

Right: From infant aged 1½ years. The germ of the second bicuspid *(5)* consists of an epithelial bud located on the lingual side of the crown of the deciduous molar, within the very thin bone at the lingual crest. *x*, occlusal end of labial and lingual bone. *PF*, palatine fat tissue and loose connective tissue.

5. Cryer, M. H.: Internal Anatomy of Face, Philadelphia: Lea & Febiger, 1916, p. 218.

6. Brophy, T. W.: Oral Surgery, Philadelphia: P. Blakiston's Son & Co., 1918, p. 652.

7. Treves: Operative Surgery, p. 173, in Brown, G. V.: Surgery of Oral Diseases and Malformations, Philadelphia: Lea & Febiger, 1918.

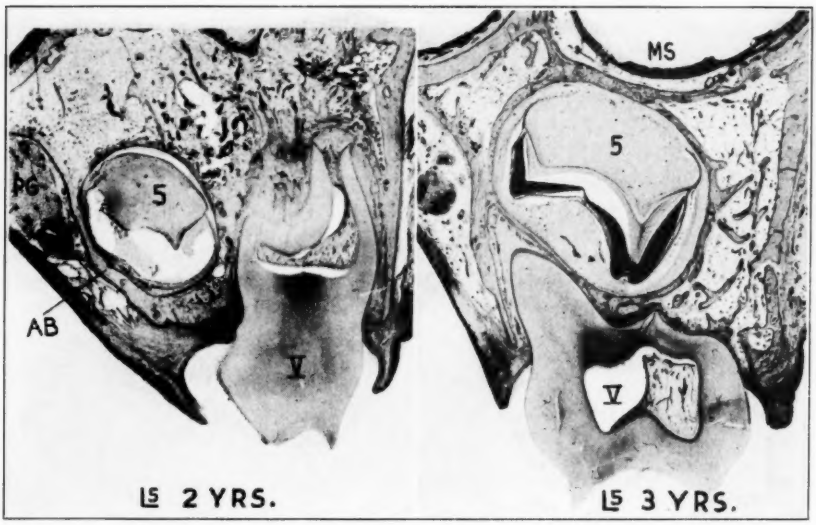


Fig. 13.—Left: From infant aged 2 years. The second deciduous molar has erupted. The germ of the second bicuspid *(5)* is differentiated into enamel organ and pulp. On the buccal cusp, the earliest formation of dentin and enamel can be observed. The germ is located on the lingual side of the root of the second deciduous molar, covered on the lingual side by a thin plate of bone, *AB. PG,* palatine glands.

Right: From infant aged 3 years. Enamel and dentin are formed on both cusps of the second bicuspid *(5)*. The germ is located above and between the diverging roots of the second deciduous molar, near the floor of the maxillary sinus. It is well encased in bone. *MS,* maxillary sinus.

(A study of the three specimens in Figure 12, left and right, and Figure 13, left, shows that, during the first year, the germ of the second bicuspid is a small epithelial bud lying in the fibrous connective tissue on the occlusal side of the deciduous crown. In this position, the bicuspid germ is not protected by bone on its occlusal and lingual side, and can therefore very easily be injured by surgical incisions on either the occlusal or the lingual side of the maxillary ridge. During the second year of life, the second deciduous molar is nearing eruption and moves occlusally. By this movement, the bicuspid germ is left behind on the lingual side and gradually becomes embedded in the lingual bone. It is not until toward the end of the third year of life that this bony encasement has developed to such an extent that incision through the lingual palatal tissues or surgical detachment of these tissues appears possible without danger to the bicuspid germ.)

Stone[8]) failed to give full information as to the possible location of the permanent tooth germs in this area at the age referred to, simply because these germs are so small at this age that they cannot be found except in well-prepared, serial histologic sections.

In recent reports,[8] it has been shown that the germs of the bicuspids branch

8. Logan, W. H. G.: Disc. of Lyons, C. J.: Etiology of Cleft Palate and Cleft Lip and Some Fundamental Principles in Operative Procedure, J.A.D.A., 17:835 (May) 1930. Logan, W. H. G.: Surgical Correction of Complete Congenital Cleft of Palate, Eighth Internat. D. Cong., Rep. III, pp. 132-149 (Aug.) 1931. Footnote 4, p. 379.

Fig. 14.—Frontal section through upper and lower jaw in plane of first deciduous molar (from infant aged 2 weeks). The approximate outline of the tongue, which has been removed during necropsy, is indicated in the drawing. The germs of the four first bicuspids *(4)* are located in both jaws on the occlusal and the lingual side of the first deciduous molars. *NC,* nasal cavity, showing inferior and middle concha. *MS,* maxillary sinus. *O,* orbit. *IV,* first deciduous molars. *4,* germs of the first bicuspids. *T,* tongue. The ridge of the mandible lies slightly within (on the lingual side of) the maxillary ridge.

off from the lingual side of the dental lamina that extends from the oral epithelium to the germ of the corresponding deciduous molar. Consequently, the bicuspid germs at birth are found embedded in the fibrous connective tissue (not encased in bone) overlying the occlusal surface of the deciduous molar, opposite the mesiolingual cusp of the deciduous molar. The bicuspid germs remain in this position for the greater part of the first year of life, and, as a rule, it is not until the beginning of the second year that they are found embedded in the bone on the lingual side of the deciduous molar. At the end of the second and during the third year, in most instances, these bicuspid germs pass into the region between the roots of the deciduous molar.

This occlusal position of the bicuspid germs during the major part of the first year of life must necessarily lead to modification of any surgical procedure performed in the field of the soft structures overlying the occlusal and the immediate lingual aspect of the maxillary ridge. Heretofore, it has been assumed that every permanent germ lies high on the lingual side of the root or above its deciduous predecessor. On this assumption, there could be no danger to the permanent germ as long as surgical interference was confined to the investment tissues of

the maxillary ridge and hard palate. But the fallacy of this belief is definitely shown by a careful study of our histologic specimens, which reveal an absence of bone encasement or protection of the bicuspids and the permanent central and lateral incisors in early infancy. To the best of our belief, this important anatomic finding, as related to surgical principles, was never referred to previous to my first report, in May, 1930.[9] The basis for this opinion can be readily explained by the lack of suitable material for anatomic and histologic studies.

Fig. 15.—Frontal section through upper portion of head of new-born child with congenital cleft of hard and soft palate. The section runs through a plane corresponding to the anterior surface of the germs of the second deciduous molars. *O*, orbits showing orbital fat. *N*, optic nerve. *M*, muscles. *NS*, nasal septum, abnormally enlarged and deviated. *P*, palatine processes of maxilla on both sides of cleft, covered, on lower surface, with soft tissue lining of hard palate, and on upper surface with nasal mucosa. *V*, germ of second deciduous molar.

These new findings are again stressed with the hope that they will be useful to all surgeons interested in this type of plastic surgery regardless of whether they follow the technic as laid down by Krimer, Warren, Langenbeck, Brophy, Lane or Veau, or that recommended by me.[10] Our specimens show that wires passed through the maxilla between the second and fourth month of life, according to the typical Brophy-Logan operation of direct application of force, need not injure either the deciduous or the permanent tooth germs if one follows carefully the newly established landmarks.

The latter statement is not by any means the result of mere logic, but has

9. Footnote 8, first reference, p. 835.

10. Footnote 8, second reference, p. 132.

been supported and established by a number of experiments[11] performed on specimens of upper jaws from infants approximately 2 months old. Typical jaw needles and silver wires were carried through these specimens in the same manner in which it is accomplished with actual patients. The specimens were then sectioned and the relative positions of the wires to the deciduous and permanent teeth were studied. The findings in these experiments demonstrated beyond doubt that, at this age (from 2 to 4 months), needles and wires can be passed through the jaw above the root ends of the first deciduous molars and lateral incisor on the long fragment without injury to the permanent germs, provided the operator is willing to take the pains to accomplish such an end.

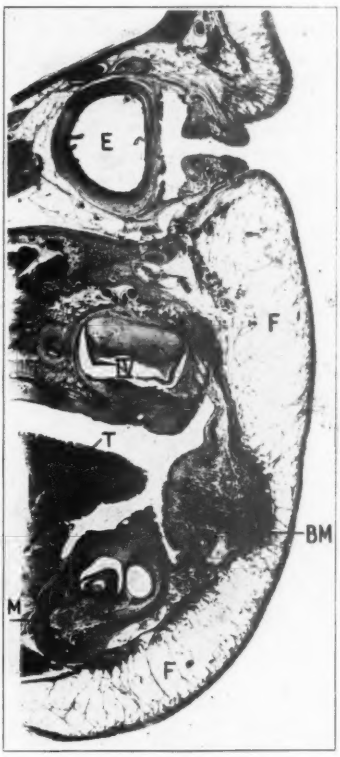


Fig. 16.—Frontal section through orbit, upper and lower jaw, cheek and tongue, at age of 6 weeks. *E*, eyeball. *IV*, germ of first deciduous molar. *BM*, buccinator muscle, forming muscular support of cheek. *M*, mandible. *T*, tongue. *F*, subcutaneous fat tissue of face.

It is thought to be appropriate here to call attention to the dental irregularities often found in cleft palate patients in general. Such irregularities may, or may not, be the result of any particular surgical technic, for they have been observed in cases wherein there had been no surgical interference previous to the time when the permanent teeth were completely developed. Within the last few months, an opportunity was presented to examine a patient who is a splendid example of the care that should be exercised in drawing conclusions as to the cause of dental irregularities following a cleft-palate operation. A typical Brophy operation had been performed by me on this patient in 1926, at the age of 3 months. A very recent roentgenographic examination of the patient, who is now 7 years old, revealed that the four upper bicuspid germs were well formed and in normal position above the corresponding deciduous molars, but that, in the lower jaw, the second bicuspids were congenitally absent (Fig. 6). Had the condition of the upper and lower bicuspids been re-

Age of Definite Bone Encasement of Upper Permanent Teeth

Teeth	Age
Central incisor	9 to 12 months
Lateral incisor	2 to 2½ years
Cuspid	Birth to 3 months
First bicuspid	1½ to 2 years
Second bicuspid	2 to 2½ years
First molar	6 to 9 months
Second molar	3 to 4 years

11. Footnote 8, second reference, p. 139.

versed and the two upper bicuspids been congenitally missing, I probably would have been of the belief that the surgical operation that I performed was accountable for the absence of the bicuspid teeth in question.

From all the foregoing, it becomes self-evident that the surgeon, when incising or detaching the investing tissues about the upper maxillary ridge in any operation, and particularly in any cleft palate procedure, should know the age when such an operation can be performed without danger to the permanent tooth germs. In other words, the question arises: At what age are the germs of the upper permanent teeth completely encased by bone of sufficient thickness to protect the delicate germs during a surgical detachment of the overlying soft tissues with the knife or with the periosteotome?

A study of our specimens indicates that the figures given in the accompanying table may be looked on as the normal age range when one can, with reasonable certainty, expect to find the germs of the upper permanent teeth protected by a well-calcified bony encasement.

From this table and from Figures 7-13, it is clear that the sequence in which the various permanent germs become progressively encased in bone corresponds approximately to the order of the beginning and the progress of their calcification, the only exception being the cuspid, which at birth, or in the first month, occupies a position high enough in the jaw to obviate any likelihood of danger by a surgical incision or detachment of the overlying soft tissues.

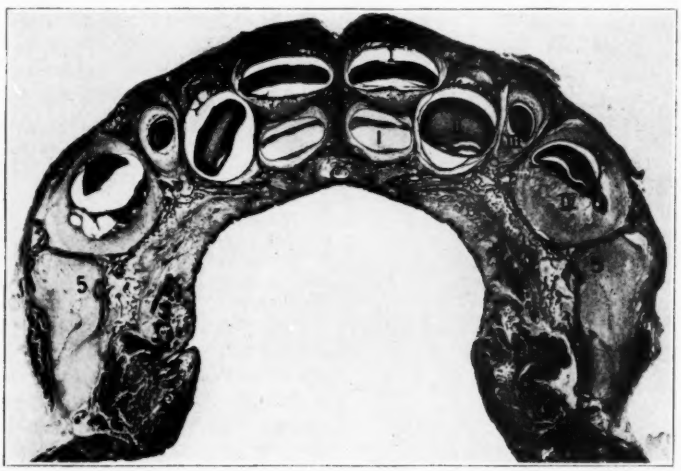


Fig. 17.—Horizontal section through upper jaw of child aged 18 days. The serial sections begin with the maxillary ridge and proceed upward through the maxilla toward the orbit. These figures represent typical sections through different levels from the ridge upward. The section is in a horizontal plane running through the incisal portion of the anterior teeth. In this, as well as in all subsequent similar sections, the deciduous teeth are marked *I* to *V*, the permanent teeth *1* to *6*. The permanent central incisors are on the lingual side of the deciduous central incisors, and the second bicuspid germs in the fibrous connective tissue on the occlusal side of the second deciduous molars.

In studying frontal sections through the region of the deciduous molars at different ages, one is impressed with the rapid increase in the height of the maxillae during the first year of life. At birth, the vertical dimension of the upper jaw is very short. The germs of the deciduous molars occupy most of the vertical space between the maxillary ridge and the floor of the orbit. At the age of 3 or 4 months, the total height of the upper jaw is almost double that at birth. Only a small part of this increase can be accounted for by the growth of the germs of the deciduous molars. Most of it is due to an increase in the height of the cancellous bone that separates the tooth germs from the floor of the orbit and the nasal fossa. Thus, from this consideration and from the foregoing discussion of the position of the bicuspid germs, I feel that it is imperative, when the principle of the direct application of force as here discussed is used as a surgical technic, that the operation shall not be performed before the maxilla has attained sufficient height to allow passing of wires safely through the bone between the floor of the orbit and the germs of the first deciduous molars (for the posterior wires) and

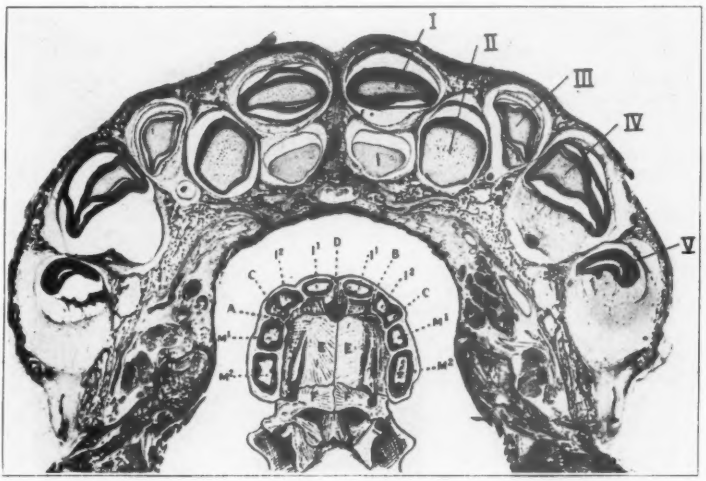


Fig. 18.—Section in a horizontal plane slightly higher than the one illustrated in Figure 17. The deciduous anterior teeth are crowded. The deciduous lateral incisors are lying on the lingual side of the deciduous central incisors and cuspids. The deciduous cuspids partly overlap the first deciduous molars and the latter overlap the second deciduous molars. (For camparison, a diagram published by Arthur Keith and used in Brophy's "Oral Surgery" is inserted in the center of this histologic section. The description of this diagram reads as follows: "Palate of a new-born child (normal size) showing the elements entering into its formation. *A*, suture between premaxilla and maxilla ending behind cuspid. *B*, the same ending behind central incisor. *C*, cuspid. *D*, vomer appearing in nasopalatine fossa. *E*, marginal part of maxillary palate. *F*, horizontal process of palate bones. It may be assumed that the small size of the germs in the specimen of Sir Arthur Keith may be explained through preparatory shrinkage of these very soft and delicate structures, and the absence of the permanent germs through the fact that they were neither calcified nor encased in bone.)

between the floor of the nasal fossa and the deciduous lateral incisor (for the anterior wires). Taking into consideration the physical limitations dictated by the elasticity and flexibility of the bone of the divided jaw, and the position of all tooth germs, the most favorable age for the direct application of force by the medium of silver wires that pass through the divided upper jaw, in accordance with the principle laid down by Brophy, or any general modification of his technic, is between the second and fourth month after birth, and the operation should never be undertaken before this date.

Thus far in our presentation, the upper jaw only has been considered. The following illustration shows a frontal section through both upper and lower jaws in their true topographic relationship (Fig. 14). In this section, which was prepared through the head of an infant of 2 weeks in the area of the first deciduous molar, all four second bicuspid germs are visible, located in both jaws on the occlusal side of the deciduous molars overlying the lingual cusps of these molars. The ridge of the mandible lies slightly linguad from the ridge of the maxilla. The tongue, which is indicated by a line drawn in its proper relation to the adjacent structures, occupies the greater portion of the curvature of the palatine vault. Although the latter observation is not new, it is again brought to the attention of all surgeons as its surgical significance has often been overlooked.

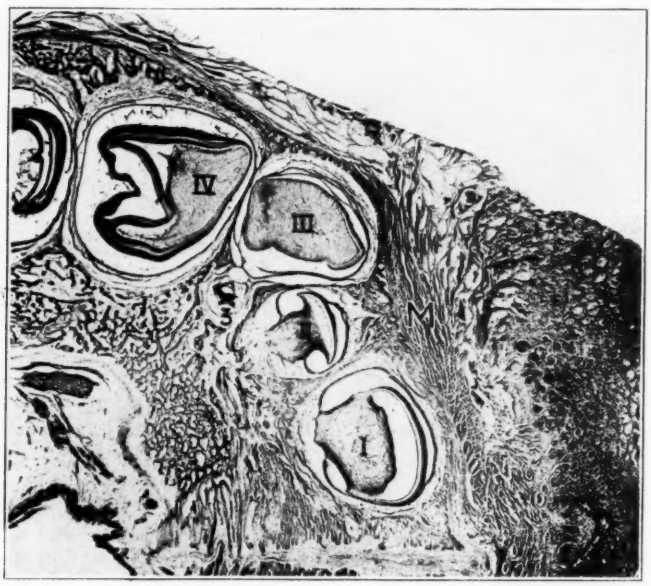


Fig. 19.—Horizontal section through anterior portion of upper jaw and upper lip of child aged 2 months. *M,* attachment of deep portion of orbicularis oris muscle and incisivus labii superioris muscle to anterior plane of maxilla, in area between central incisor and cuspid.

Frontal sections through an upper jaw

with a cleft of the hard palate furnish valuable and instructive information regarding the tissues present on both sides of the cleft and the surgical possibilities of the repair of such a deformity. Figure 15 shows a section through the upper portion of the head of a new-born child with a wide cleft of the hard and the soft palate. On both sides, the cleft is bordered by the blunted margin of the palatine process of the maxilla. The mucous lining of the oral and of the nasal cavity is continuous along the borderline of the defect. In the surgical closure of such a cleft, two main principles have been utilized: (1) the Warren or Langenbeck operation and (2) the turnover-flap operation, the principle of which was

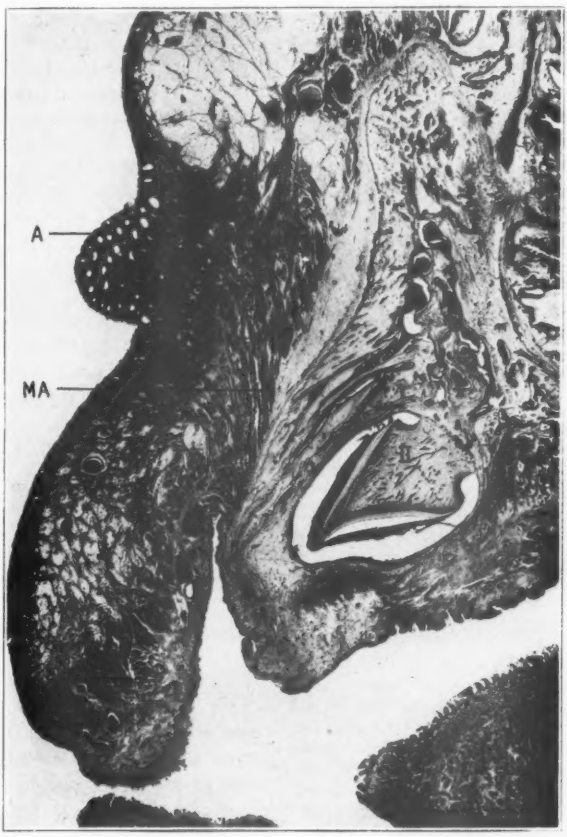


Fig. 20.—Sagittal section through area of lateral incisor in child aged 6 weeks. There is extensive attachment, *MA*, of the deep muscle fibers of the lip and of the nasalis muscle to the bone overlying the germ of the deciduous lateral incisor, *II*. (Compare also Figs. 4 and 19.) *A*, tangential section through ala of nose.

first laid down by Krimer in 1824, and which, since May, 1929, I have used in a modified form.

In the Langenbeck operation, the lining of the palate is detached laterally from the border of the cleft, the tissue remaining attached near the maxillary ridge for its entire length, unless, through necessity, lateral incisions of various lengths are required to make coaptation in the median line possible. Then the two lateral flaps are dropped down until the borders can be brought close enough to allow for suturing. It is obvious that, by such an operation, the height of the vault is considerably reduced, which is an objectionable feature because the major portion of the tongue must lie in this

Fig. 21.—Hypoplastic enamel in patient aged 18 years. The distribution of the hypoplastic defects corroborates the sequence of formation and calcification of these teeth. Upper jaw: Right cuspid, incisal one-third of crown hypoplastic; lateral incisors, enamel normal; central incisors, more than incisal one-third hypoplastic; left cuspid missing; left and right first and second bicuspids, enamel normal; first molars, hypoplastic. Lower jaw: Cuspids, lateral and central incisors, incisal one-third hypoplastic; bicuspids, enamel normal; first molars, hypoplastic.

curvature when the mouth is closed. Therefore, when possible, the normal size and height of the vault should be retained as an aid to voice resonance.

In my turnover-flap operation (modified Krimer operation), a different principle is employed. The soft tissues are detached on one side from the periphery (far enough inside the lingual aspect of the maxillary ridge to avoid the permanent tooth germs) toward the border of the cleft; but at the border itself, they are left attached. Then, with the border of the cleft on the long side as a hinge, the whole flap is everted and sutured to the border of the cleft on the opposite side, or, by preference, passed beneath the elevated strip of the periosteum on the short side. By this procedure, the height of the vault, which is normally occupied by the tongue, is not reduced and the cleft is closed in the level of the bone borders of the hard palate.[12] Thus, a more satisfactory anatomic outline to the dome of the palate is established, and we may hope for a more physiologic end-result as far as speech is concerned.

The location of the buccinator muscle can be studied in large sections through jaws and cheek (Fig. 16). This muscle extends from the maxilla to the mandible, and, in its upper and lower portion, consists of a rather thin layer of muscle fibers. It is much heavier in the middle of the cheek and causes the overlying mucosa to project into the buccal vestibulum.

HORIZONTAL SECTIONS

The arrangement and relative position of the germs of the deciduous and permanent teeth can be better studied in horizontal serial sections through human jaws than in any other plane. Sections taken from infants at birth, at the age of 2 months, 6 months, and 9 months, will be here described, and an effort will be made to show how the positions of the various tooth germs lead to modification of surgical procedures performed on the jaws in infancy.

12. Footnote 8, second reference, p. 144.

In horizontal sections through the entire upper jaw of a child who died eighteen days after birth, the most striking feature is the very crowded arrangement and overlapping position of the deciduous germs (Figs. 17-18). The permanent lateral incisors lie on the lingual side of the deciduous central incisors and the deciduous cuspids. The latter, in turn, overlap the mesial portion of the first deciduous molars. This histologic picture is decidedly different from most of the previous illustrations of the jaws of new-born children. Attention should be called, for instance, to the diagram of Sir Arthur Keith[13] (Fig. 18, center), which shows the deciduous germs at birth in definitely separated bony compartments, with ample space betwen the individual germs. A similar diagram is found in Mummery's textbook.[14]

It is not difficult to understand how these earlier investigators arrived at conclusions so different from our findings. These men apparently used dry or anatomic specimens for their studies. The permanent tooth germs, which are usually not calcified at birth, consist of a fleshy gelatinous mass of pulp and enamel organ, which is completely lost or at least greatly shrunken and contracted in any preparation in which the tissues are not preserved in a state of perfect histologic fixation immediately after death. For this reason, in the earlier preparations, the germs appear much smaller and the space between them appears much wider than in any of our well-fixed specimens.

Fig. 22.—Horizontal section through anterior portion of right maxilla of child aged 9 months. *IC,* incisive canal containing two small cysts. *1,* incisal edge of permanent central incisor. *2,* germ of permanent lateral incisor, consisting of pulp and enamel organ without hard tissue formation. (Compare Fig. 21.)

13. Keith, Arthur, in Brophy, T. W.: Oral Surgery, Philadelphia: P. Blakiston's Son & Co., 1918, p. 589.

14. Mummery, J. H.: Microscopic and General Anatomy of Teeth, Ed. 2, London: Oxford University Press, 1924.

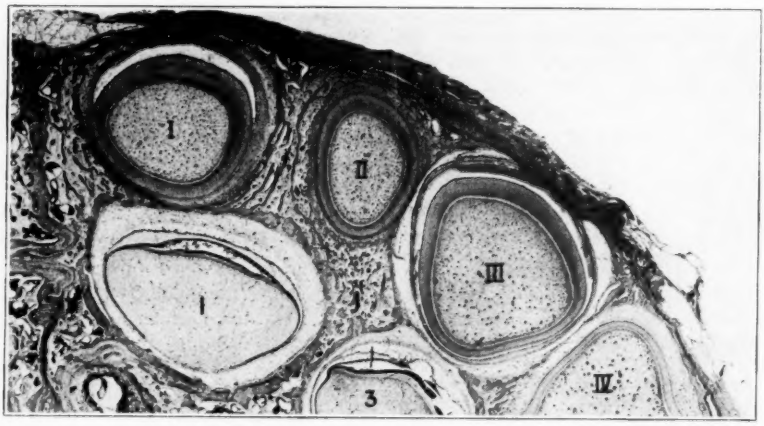


Fig. 23.—Horizontal section through same specimen as Figure 22, in a slightly higher level. There is uniformity in the development of the permanent central incisor *(1)* and the permanent cuspid *(3)* as compared with the permanent lateral incisor (Fig. 22, *2*), which is considerably behind in development. This relative difference in development of the upper permanent central incisor, lateral incisor and cuspid finds its clinical expression in the relative distribution of enamel hypoplasia in these teeth, as shown in Figure 21.

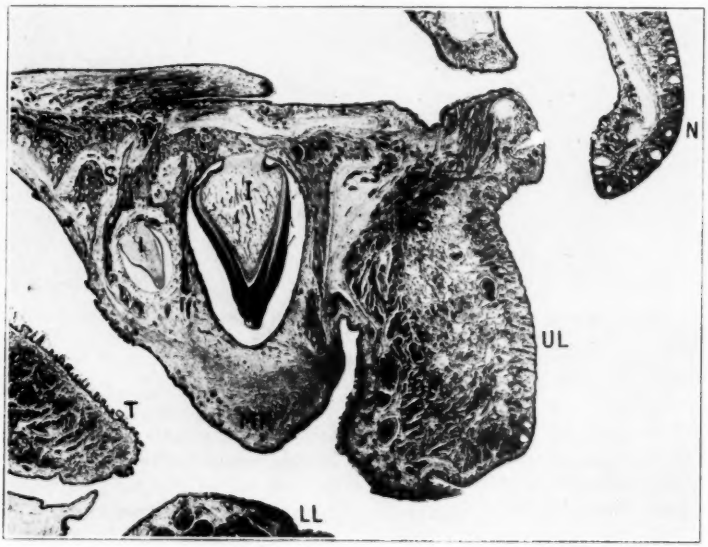


Fig. 24.—Sagittal section through upper lip, nose and jaw of child aged 6 weeks. *N*, tip of nose. *UL*, upper lip. *OM*, bundles of orbicularis oris muscle in cross-section. *DS*, depressor septi muscle. *MR*, fibrous tissue of maxillary ridge. *I*, deciduous central incisor. *1*, permanent central incisor. *S*, suture between premaxilla and maxilla. *T*, tip of tongue. *LL*, lower lip.

Figure 19 shows a horizontal section taken from the anterior part of the upper jaw of a child of 2 months. The upper lip was left attached to the jaw, which made it possible to study the relationship between the lip and the jaw bone. The muscles of the upper lip show a broad attachment to the anterior plane of the maxilla. This attachment extends horizontally from the canine eminence continuously over the area of the lateral incisor to the bony eminence overlying the deciduous central incisor. In the vertical dimension, the muscle attachment is found to extend upward to a higher level than the floor of the nasal fossa (Fig. 20). The clinical and surgical significance of this muscle attachment has been discussed in the earlier part of this report.

At the age of 6 months, the jaw shows a considerable increase in size. The formation of dentin and enamel has begun in the upper permanent central incisor, upper permanent cuspid and upper permanent first molar. The upper permanent lateral incisor is far behind in development, a fact that has been pointed out in a previous report,[15] and is borne out by the relative distribution of congenital defects (enamel hypoplasia) of the anterior teeth (Fig. 21).

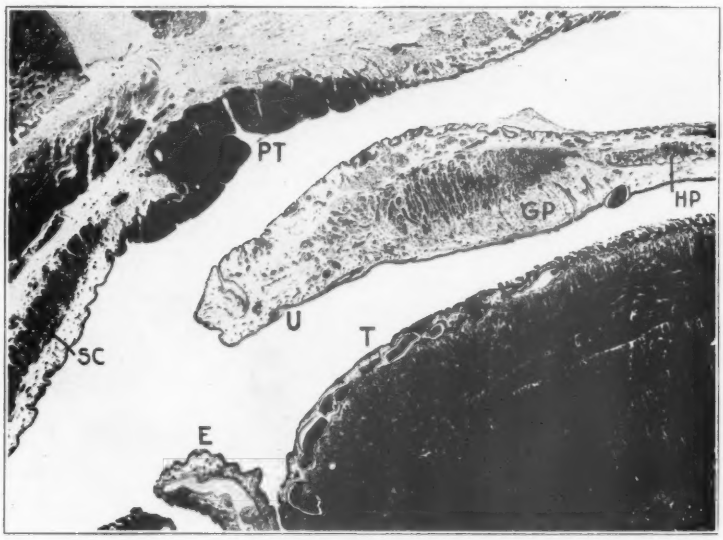


Fig. 25.—Sagittal section through soft palate, uvula, dorsum of tongue and pharynx of child aged 6 weeks. *T,* tongue. *E,* epiglottis. *HP,* hard palate. *GP,* glands of soft palate. *MP,* muscles of soft palate. *U,* uvula. *PT,* pharyngeal tonsil. *SC,* superior constrictor pharyngis muscle.

In horizontal sections through the maxilla of a child of 9 months, the difference in the state of development between the central and the lateral permanent incisors can easily be recognized (Figs. 22-23). It must again be emphasized that, owing to the marked difference in

15. Footnote 8, third reference.

the horizontal level of the various germs, it is not possible to demonstrate all of them in any one section. The serial sections begin at the maxillary ridge and proceed upward toward the floor of the nasal cavity. Since it is a general rule that (except at the time of eruption) the closer a permanent germ is to the maxillary ridge, the less developed it will be, it is not surprising that the germs of the bicuspids and lateral incisors are the first permanent germs disclosed in such a sequence of sections (Fig. 22). At this age, the permanent lateral incisor consists merely of a soft mass of enamel epithelium and pulp. No enamel or dentin has as yet been formed. In sections prepared in a higher level (Fig. 23), the large germ of the permanent central incisor occupies all the space linguad from the deciduous central and lateral incisors. On its distal edge, this germ almost comes in contact with the germ of the permanent cuspid. A considerable amount of enamel and dentin are already formed in both the permanent central incisor and the cuspid.

A comparison of horizontal sections at different ages gives a very interesting insight into nature's economy of space. For instance, it is known that the mesiodistal width of the germs of the deciduous anterior teeth does not increase much after birth. Most of the postnatal growth of these germs takes place through increase in thickness and length (height) of dentin and enamel, but the mesiodistal width of the final incisal edge does not

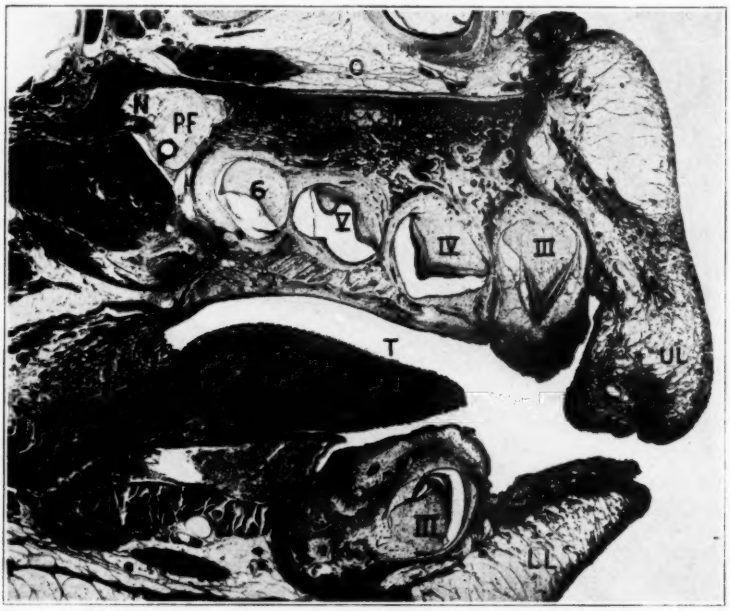


Fig. 26.—Sagittal (anteroposterior) section through lateral portion of upper jaw of child aged 6 weeks. *UL*, upper lip. *O*, orbit. *PF*, pterygopalatine fossa. *N*, second division of fifth nerve. *T*, tongue. *LL*, lower lip. *M*, mandible. *SL*, sublingual gland. *DM*, digastric muscle.

change much after birth. Thus, the question naturally presents itself: How is it possible that in the jaw of the newly born child, one finds the same number of germs as in the larger jaw of a child of 9 months? A simple comparison of Figures 18 and 23 will answer this query. As shown in Figure 18, the deciduous lateral incisor, shortly after birth, lies linguad from the deciduous central incisor and deciduous cuspid. The distance between the latter two teeth is less than one-half of the mesiodistal width of the deciduous lateral incisor. At the age of 6 months, the deciduous central incisor and cuspid have moved apart, and the deciduous lateral incisor has moved labially and stands almost in line with its neighbor. Finally, at the age of 9 months (Fig. 23), enough space has been created by the growth of the upper jaw to cause the deciduous central incisor, lateral incisor and cuspid to stand in a perfect arch; whereas, the germs of the permanent central incisor and cuspid occupy most of the space on the lingual side of the three deciduous anterior teeth.

SAGITTAL AND RADIAL SECTIONS

In large frontal and sagittal sections prepared through the head and neck (at approximately 6 weeks), the topography of the various structures of the oral cavity can be studied.[16] The tongue is shown in its normal relation to the vault of the palate in such sections, and it can be easily understood that any operation that decreases the height of the vault is likely to interfere with the normal position and function of the tongue and uvula (Figs. 14, 25) and may have a detrimental influence on speech.

In a higher magnification of the anterior portion of one of these sagittal sections, the attachment of the upper lip to the maxilla, the position of the germs of the deciduous and permanent central incisors and the structure of the maxillary ridge can be recognized (Fig. 24). A photomicrograph of the posterior portion of a sagittal section through the median line (Fig. 25) shows the soft palate and the uvula in their relation to the posterior and superior surface of the pharynx, to the dorsum of the tongue and to the aperture of the larynx.

In sagittal sections through the upper lip and jaw in the area of the lateral incisor, the extensive attachment of the deep muscles of the upper lip to the anterior plane of the maxilla has already been described (Fig. 20). Having emphasized the significance of this attachment, it is sufficient to add that proper function of the lip and normal configuration of the nostril following plastic surgery (cleft palate and cleft lip operations) can be expected with a greater degree of certainty when a normal attachment to the underlying bone has been provided either previous to or at the time the lip is operated on.

Sagittal sections through the lateral portion of the upper jaw include the germs of the deciduous cuspid, the first and second deciduous molars and the first permanent molars (Fig. 26). The pterygopalatine fossa is visible behind the maxillary tuberosity. The second branch of the fifth nerve can be seen as it passes through the foramen rotundum on the base of the skull. In the bone plate anterior to the cuspid germ and posterior to the germ of the first permanent molar, the bone is arranged in horizontal spicules. Each spicule shows resorption of the side facing the tooth germ, and new formation on the opposite side; which indicates that the maxilla is growing anteriorly and posteriorly at the same time.

From the findings here described, and from those discussed in previous reports,

16. Footnote 4, p. 390.

it would seem that this histologic study of the anatomic structures of the jaws and related oral and facial tissues has been productive of a number of interesting interpretations that are believed to be facts. Other workers in this field are urged to make similar investigations in order that the statements herein set forth may be confirmed or errors may be corrected.

PRESENT TRENDS IN OPERATIVE PROCEDURE AND THEIR POSSIBLE INFLUENCE ON DENTAL EDUCATION*

By ARTHUR TAYLOR ROWE, D.D.S., F.A.C.D., New York City

TO foretell the possible effect of new stimuli on a people or organized groups of people, it is well to review their history to see how they have reacted in similar situations. In attempting to deduce the effects that changes in dental practice may make on dental education, one must study the relationship that has existed between the two in the past.

In its inception, dentistry was an expression of individualism, and that individualism persisted for some time after dental education was an organized entity. It was the usual procedure for dental students to associate themselves with established practitioners either before or after attending dental school, receiving or augmenting their training by preceptorship. This method of instruction was recognized by the various state boards of examiners, and men were admitted to examination for license on presenting evidence of having spent a certain length of time under a preceptor and having taken a stated number of lecture courses in a medical or dental school.

During the first epoch of dentistry, development was almost entirely along mechanical lines. Members of the profession were constantly improving instruments and equipment. New appliances were being devised and various methods for the attachment of artificial substitutes were advanced and advocated. Dentists became strongly partisan for this or that method because it had proved satisfactory in a limited number of cases. No systematic study was conducted of the fundamental mechanical and biologic principles involved, and none of the premises advanced were developed to the point of becoming established principles. The experienced practitioner, given a certain set of conditions, could, in many cases, make a fairly satisfactory restoration, but he was unable to epitomize the reasons for his selection, and could not convey his reasons in an understandable form to another. His disciples could only follow the details of the technic blindly and hope for the best.

We owe much to these pioneer craftsmen for the mechanical excellence and ingenuity that have characterized American dentistry, but, on such a basis of empiricism, it was natural that methods were continually changing and that there

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 7, 1934.

were almost as many different systems as there were practitioners.

Since no study of fundamentals had determined underlying principles of sound procedure, each operation was an experiment in the individual case. Time, of course, proved the value of those methods which were fundamentally correct, and the schools confined themselves to teaching the tried and proved; but they failed to evaluate the basic principles by research, and continued to teach a long program of technic that was to a large extent repetitious. Such teaching was not education, but vocational training, since proficiency was obtained by mechanical repetition rather than by mental development. Emphasis was placed on the ability to imitate and not on the ability to reason from cause to effect.

A series of apparently unrelated events marked a great change in dentistry. They were, in order, the development of dental radiology and of the Taggart casting process, Hunter's challenge to dentistry, the research of Billings and Rosenow and the Carnegie survey of American dental schools. The first four of these not only demonstrated the deleterious effect of much of the accepted procedure, but also provided a means of doing restorative work that was biologically sound. The survey pointed out the deficiencies in the educational system as it was then organized. Thus, the concept of the dentist's responsibility to the patient changed and, in addition, a deeper realization of the responsibility of the dental school to the student and to society developed. Changing the emphasis from restorative practice to preventive practice marked the transition of dentistry to its rightful place as an essential part of any health service.

The combined result of this change in dental practice and the survey had a decided effect on dental education. Curriculums were revised to provide the training in biologic science so necessary as a foundation for intelligent approach to practice. Teaching was reorganized and entrance requirements were raised. The addition of so much material to the curriculum resulted in a necessary curtailment of time in branches that had been overemphasized, and technic teaching was revised. The various principles involved were evaluated and combined, the student being thus enabled to obtain a better understanding of restorative procedure in less time and with fewer operations. It is interesting to observe that one of the few things that stood the test of time and analysis was the gold foil technic and the principles of cavity preparation laid down so long ago by Black and based on the fundamental biologic principles of histology.

Another result of this changed concept has been a change in character and conduct of research. In the early stages of the development of dentistry, the individual practitioner was able to work out mechanical improvements by himself. Cooperative effort and expensive equipment were not essential and, for the most part, research was in the hands of the profession. The schools, most of them privately owned, were more concerned with large classes than in contributing to the sum of human knowledge. As they are organized today, research is a prominent phase of their activity. The problems to be studied are such that they require the cooperation of men trained in the several biologic sciences. Expensive equipment and technical personnel have called for large grants of money from the foundations. Such grants are not as a rule given to individuals. The result has been that persons interested in research have become affiliated with educational institutions, and the schools are becoming the leaders rather than the followers of the

profession. The falling off of the number of men entering the profession of dentistry has excited some alarm. It would seem that it might only be the natural result of the raising of standards and preparation time, which as yet has not had time to be reflected in the general public's estimation of dentistry. As soon as the results are appreciated, the type of man called for will be entering the profession.

What are the imminent changes in operative procedure? What are the probable changes in practice that are to be faced? What are the chief reasons for having dentists at all? Perhaps by answering the last question first, we shall be able to answer the others. Caries, periodontal disease, nutritional disturbances and developmental arrests and anomalies are the main reasons that dentists are needed. Prevention, then, would solve most of the dental health problems. As yet, we do not know the cause of caries; our knowledge of the cause of periodontal lesions is slight, and nutritional and metabolic disturbances with their attendant arrests in development are certainly not well understood. Our changes in operative procedure are all directed toward methods that will prevent decay and dental ills and constantly reduce the amount of restorative dentistry necessary. Preventive treatment will increase as biologic research widens the scope of our knowledge. Restorative dentistry can be preventive, or it can be only a step in a progressive program toward edentition. If teeth can be kept in a state of vitality, the problem of secondary infection from periapical abscess is removed. The effect of such changing operative procedure on dental education should be an increased emphasis on research. It should mean not only that sound training be given in biologic science but also that the application of that biologic training should be made in clinical teaching and the whole program directed toward a recognition of causes and their correction rather than palliative measures to repair the results of such omission.

In the face of the imminent arrival of some form of state dentistry, the part of dental education will be, not the teaching of short cuts or methods of cheap service of a restorative nature, but the discovery of causes of dental disease and the training of men to be able to recognize incipient conditions and, by their correction, avoid a long series of sequelae that will be expensive in time, health and money to the affected person. Economies to the public in dental service can be accomplished only by means of: (1)) lower costs, by reduction of overhead through centralization, and (2) the high type of service rendered. Delegation of service to poorly trained assistants, while reducing the cost of the individual operation, would only increase the cost in the long run and would allow the profession of dentistry to degenerate.

The future of dentistry lies in the hands of the dental schools. They select the men entering the profession, give them their basic training and foster their ideals. It is the privilege and duty of the dental schools to see that the men coming into the profession enter it feeling that they have been given the opportunity to become one of a group dedicated to the service of humanity. As operative methods and practices change in harmony with the aspirations and ideals of such a body of men, the result in education will probably be a gradual growing together of the several branches of the healing art. Research will be an associated effort in the common biologic field of medicine and dentistry, and the result will be a better understanding of common problems.

MANIPULATION OF DENTAL PORCELAIN*

By E. BRUCE CLARK, D.D.S., Uniontown, Pa.

REGARDLESS of the ever-increasing interest manifested by the dental profession in the use of porcelain, its technical development has been slow. Perhaps this is because porcelain manipulation is generally considered difficult. I shall not deny this assumption, but I prefer to classify porcelain technic with that of the gold inlay as an exacting technic, rather than a difficult one. An exacting technic may or may not be difficult, but it is one that will not tolerate carelessness in the manipulation of any of the materials used.

Most of the difficulties that arise in dental ceramics can be eliminated by careful attention to details. It is true that certain factors, such as cavity preparation, color selection and carving, require a degree of skill, but most other factors in the perfection or failure of a porcelain restoration are directly related to manipulation. Air bubbles, lack of density, excessive contraction, warpage of the matrix and failure to reproduce the color selected can be traced directly to the execution of some step in the manipulative process and firing technic. Each step is developed and executed solely for the purpose of controlling some one of the many physical changes that take place in the structure of the porcelain body from the time it is made plastic by the addition of water until it is finally glazed.

*Read before the Section on Partial Denture Prosthesis at the Seventy-Sixth Annual Session of the American Dental Association, Aug. 8, 1934.

Fortunately, these physical changes are not so mysterious as is the chemical decomposition that takes place during the process of firing. We are all more or less familiar with them, and it is therefore my desire only to connect certain of these physical characteristics with those manipulative steps that are so essential to the structural development of the finished restoration.

STRUCTURE

Dental porcelain, like the glazes used in industrial ceramics, has a vesicular structure. It is not porous. We have probably borrowed the term "porosity" from industrial ceramics, where it is used to designate products that have the ability to absorb fluids, the amount of porosity being determined by the weight of water a certain product is capable of absorbing. We speak of dental porcelain as having pores, air spaces or blebs. These are sealed pores and do not communicate with each other. They can best be studied under a wide-field binocular microscope provided with objectives giving a magnification of 7 and 14 diameters. Their presence determines the vesicular nature of the porcelain. If they are large and in great quantities, the porcelain is said to have a poor vesicular structure; if they are small and few, the vesicular structure is good.

The pores or blebs arise chiefly from two sources, entrapped air and gases liberated by the feldspar under high heat. Blebs may arise from other sources in low fusing porcelain, such as vapors from

combined water and gases liberated by the oxidation of organic material, carbonates and other fluxes. But since these are driven off below 1800 F., there is little danger of their influencing the structure of our high-fusing materials under proper firing. The larger pores, visible to the naked eye, are usually due to entrapped air, since they are not present in carefully manipulated porcelain. The microscopic pores are gas blebs.

Occasionally, we will see, in a sample of fused porcelain, a small area free of pores and of uniform texture. To produce an entire dental restoration with porcelain of this quality is apparently impossible with the materials now in use. The othoclase feldspar used in dental porcelains is mined in crystalline form, in which it exhibits maximum density, since no pores are present. When a sample of crystalline feldspar is fired at a vitrifying temperature, thus being converted into an amorphous solid, pores appear throughout the entire structure, and in areas in which the crystalline structure has been disturbed by checking or fracture, the pores appear in countless numbers.

It did not occur to me to fire feldspar in this manner until after I had spent considerable time attempting to condense porcelain to such a degree that no pores would appear on firing. Finally, when condensation under 150 tons of hydraulic pressure failed to produce a sample of nonvesicular structure, I was convinced that no successful methods applicable to dental procedure could be devised, and the firing of crystalline feldspar seems to support this conviction.

I mention these experiments simply as a matter of interest. I do not wish to imply that condensation is not all important to the texture of any porcelain product. Condensation of dental porcelain minimizes shrinkage and reduces the pores in size and number, thus increasing the density and strength of the finished product.

ELIMINATION OF ENTRAPPED AIR

As was previously stated, the larger pores or blebs in porcelain arise chiefly from the presence of entrapped air and the smaller ones from the presence of gases, evolved by the dissociation of feldspar. When the larger blebs are apparent in the finished product, we usually attribute them to faulty technic in condensation. It is quite possible to remove air from a mass of plastic porcelain by condensation, but it seems more logical and is unquestionably more satisfactory to remove the air before condensation is begun.

Dental porcelain is a difficult material to "wet down," especially the kaolin content and finer particles of feldspar. Air fills the interstitial spaces and seems to cling to the surfaces of every granule as well. When water is added, this air must be displaced. The colloidal nature of a certain proportion of the porcelain seriously interferes with this displacement and, as a result, tiny bubbles are formed. These bubbles continue to form for some time after the water is added and cease forming only when every surface of each granule becomes wet.

Every porcelain worker should occasionally check up on his technic of mixing porcelain to make sure that the method used is removing all air from the mix. This can be done by spreading the mix out in a thin layer on a glass slab and examining it over a flashlight or strong mouth lamp in a darkened room. If when the light is held against the bottom of the slab directly under the mix, bubbles are present, it is evident that the mixing technic is not effective and that it should be altered and improved to the point where not a single bubble can be seen in the mix.

It is difficult to remove all air by spatulation alone, especially when a large amount of porcelain is mixed. The use of a vibrator as an aid while spatulating is advantageous. Mixing in a small mortar is a very effective method if the mortar is placed on a vibrator while the mixing is done. Pressure with the pestle must be very light so that the porcelain will be stirred only and not ground. The stirring thins the mix out on the sides of the mortar while the vibrations expel the air. Enough water should be used that the surface of the mix will not craze while stirring.

The mouth of the mortar is moistened with a wet finger before the mix is poured out. If the mix is to be poured onto a slab or into a dappen dish, the surface of these should be moistened in the same manner. Pouring must be done on the vibrator in order to make the porcelain flow.

Porcelain in amounts sufficient for an inlay can be mixed directly in a dappen dish with a small glass rod for a pestle.

The mix should be kept saturated at all times. If it is allowed to dry out, the mixing process must be repeated, as air will have again filled the interstitial spaces during the dehydrating process. Porcelain is difficult to keep saturated on a slab. It is more easily kept in proper working condition in a dappen dish. If it is necessary to allow the material to stand for a time before using, the dappen dish should be covered to prevent evaporation.

The proper amount of moisture should be maintained in the material on the matrix during the restoration, as well as in that remaining in the dish. This can be done effectively by the use of a DeVilbiss atomizer attached to the laboratory bench. The atomizer is provided with a hand bulb, which is connected to the nozzle by a short rubber tubing. The tubing can be replaced with a piece of stethoscope tubing about 7 inches long, so that the bulb may hang down over the edge of the bench. The small lumen in the stethoscope tubing will not be closed up by the weight of the bulb, as would happen with an ordinary piece of rubber tubing. When a small amount of moisture is desired, the material or the dappen dish is held about 12 inches away from the nozzle of the atomizer. When more moisture is desired, the material may be held closer to the atomizer, and thus the amount of water to be applied is controlled at all times.

CONDENSATION

The purpose of condensation is to further improve the quality or texture of the finished product and to reduce shrinkage to a minimum. By condensation, we mean bringing the porcelain particles into the closest possible relationship. If it were possible to condense porcelain to the state wherein there would be no interstices, there would be no shrinkage, except for the amount resulting from ignition loss, which is as low as 0.5 per cent in some porcelains. The shrinkage occurring in dry porcelains condensed by hydraulic pressure is negligible.

The ignition loss of a porcelain is determined by firing a definite amount of dry powder by weight at approximately 1800 F. and, when cool, reweighing the material. The loss in weight is the ignition loss. This loss is due to the carbonization of organic materials and the liberation of combined water and other gases. The loss will vary in the porcelains we use from 0.5 to 2.5 per cent.

Certain porcelains will shrink slightly more than others owing to the proportionate size of their particles. Porcelains having an excessive amount of small

particles will shrink slightly more than those materials in which the particle size is properly balanced. This feature, together with ignition loss, is responsible for only a small percentage of the shrinkage that takes place. Most of the contraction is due to our inability to secure complete condensation.

The amount of contraction that takes place in our practical work will vary from 9 to 20 per cent, depending on the method used to condense the material and the diligence with which it is applied. As previously mentioned, this amount of shrinkage will vary slightly with different materials, but scarcely over 2 per cent, so that it is safe to place the average minimum shrinkage of dental porcelain at 10 per cent. All shrinkage above this amount is therefore within the operator's control, since it depends entirely on how well the material is condensed.

To secure porcelain of maximum density and minimum shrinkage, it is necessary to condense it by the vibration method. This method takes advantage of two physical forces which are alone responsible for the density secured: gravity and surface tension. The force of gravity becomes active in this method because the porcelain particles are heavier than the water which they displace. It contributes its greatest action when the porcelain is condensed into an area confined by surrounding walls. This force is very slight compared to the force exerted by the surface tension of the water.

The difference in the two forces can be easily demonstrated by a comparison of the action of porcelain in water and in alcohol. Since alcohol has a specific gravity of 0.79, the force of gravity is 20 per cent more when alcohol instead of water is used as a medium. In spite of this advantage that the one has over the other, it is quite impossible to secure thorough condensation with the use of alcohol, owing to its low surface tension of 24.5 dynes per centimeter, that of distilled water being 73.5. We therefore use water as a medium for the condensation of porcelain; i.e., because of its extremely high surface tension and its low viscosity. When a camel's hair brush is immersed in water, the bristles stand apart as freely as in air; but when it is withdrawn, they cling together by the contraction of the surrounding water. If

FUSING CHART FOR VARIOUS DENTAL PORCELAINS*

Type	SSW-MF Fluxed	SSW-HF Fluxed	Justi-MF Fluxed	Justi-HF Fluxed	Dentsply Non-fluxed	T.C. Non-fluxed
Ignition loss	0.5%	2%	1%	2%	0.5%	2.5%
Vitrification begins	1750	1950	1470	1950	2150	2200
Low carving biscuit	1800	2000	1520	2000	2200	2250
High biscuit	2120	2300	2000	2350	2400	2460
Glazing temperature	2160	2400	2070	2400	2400	2460
Glazing time	3 min.	5 min.	3 min.	5 min.	5 min.	5 min.

*The data in this chart is accurate only when the pyrometer has been set to fuse S.S. White High Fusing, Justi High Fusing or Dentsply at 2400 degrees F. The point is determined on the pyrometer at which an egg-shell glaze will be produced by firing samples of any one of these three porcelains at the rate of 50 degrees per minute and holding at the maximum or glazing temperature for five minutes. The indicator is permitted to idle at this point and then adjusted to 2400 F.

more of the water is driven off by drawing the brush through the fingers, the bristles will cling still closer together.

The action of surface tension is precisely the same in the condensation of porcelain. Porcelain particles suspended in an excess of water do not cling together. When this excess water is absorbed, there is a mechanical interlocking of the particles. The porcelain is vibrated to break up the mechanical interlocking, and thus the particles are thrown again into suspension, as it were, and the force of surface tension is permitted to contract the entire mass and force additional water to the surface. The same procedure is repeated again and again until the water content is reduced to a minimum; at which point, the force of surface tension is at its maximum.

Surface moisture should be absorbed by touching the work lightly, avoiding pressure. Excessive pressure may disturb the particle arrangement that has already taken place. Nothing should be allowed to interfere with or retard this process of condensation, such as the hydroscopic action of a working model or the investment of a matrix. Provision should always be made for preventing this action. The porcelain should never be allowed to dry out until condensation is complete. If it is kept at proper saturation, additional water, added from the spray bottle, will remain on the surface only, thus placing it in the correct condition to receive additional porcelain, which is condensed in precisely the same manner.

As the vibrating method cannot be used exclusively in all types of work, it is often necessary to make use of the so-called spatulation method. This method is also effective, and when used in combination with vibration, produces porcelain of good texture, but usually with considerably more shrinkage. In the spatulation method, the particles are burnished to place with the side of the carving instrument. The porcelain may be used in a dryer consistency for this method. Several additional applications and firings are usually required to complete the building up, in order to compensate for the excessive shrinkage which occurs, since the force of surface tension is not utilized to its full advantage.

SHRINKAGE

Surface tension is also the force that causes the contraction of porcelain during the firing process. Fluxes in combination with feldspar form eutectic compounds, which become fluid at lower temperatures than do the remaining ingredients. The surface tension of these fluids is responsible for the firing shrinkage.

During firing, porcelain shrinks or "pulls" in two directions: to the center of the bulkiest portion and to the surface on which it is applied. The force of cohesion which attaches the fusing porcelain to its underlying surface is increased if that surface is the point of greatest heat. The force of cohesion is greater in fluxed porcelains than in nonfluxed material.

The force or pull in these two directions is usually antagonistic. If the matrix of a class 5 inlay is completely filled with porcelain and fired, the shrinkage will be toward the center of the mass and toward the matrix as well, resulting in the appearance of cracks and warping of the matrix, because the forces are pulling in opposite directions. In almost every porcelain restoration, there must be some provision for the relief or elimination of the pull in one direction. The case should be studied before the building up, to determine how this can best be accomplished. There are various methods, such as the use of shellac, ditch-

ing, cross-cutting, applying porcelain in thin layers to avoid bulk and investing the matrix. Cracks and warpage resulting from the pull of shrinkage can always be minimized by thorough condensation, but never completely eliminated.

FIRING

A great deal of stress has been laid on the importance of firing dental porcelain and its resulting influence on the structure of the finished product. Many technics have been described, with many variations. Some writers advocate high temperature for a short time, while others advise lower temperatures for a longer time. Some increase the temperature slowly, others more rapidly. Some operators are so cautious about applying heat to their porcelain that forty or fifty minutes is required for one firing. On the other hand, the thousands of artificial teeth that are used annually are all fired much more rapidly than is even possible in our small electric furnaces. These teeth are first subjected to a temperature of approximately 1800 degrees for 3 or 4 minutes. They are then placed directly in another muffle heated to such a high temperature that only five to seven minutes is required to completely vitrify and glaze them. This generally accepted technic among manufacturers is in striking contrast with some of our slow firing methods.

I feel certain that the men who have devised the many firing technics have all secured porcelain of excellent quality; otherwise, they would not suggest and recommend them, and since such vast differences do appear in the various technics, they alone would seem to be evidence that the structure of dental porcelain is more dependent on other factors than on the method of firing.

The firing of dental porcelain, regardless of method, is a procedure that requires strict attention to details in order to prevent the very serious results of overfiring. The factor that seems most important to me in this respect is the syncronization of time by the clock and temperature by the pyrometer, in spite of the fact that certain experienced operators are capable of firing porcelain without the aid of either. Time and button firing is inaccurate if there are changes in current voltage. Pyrometric temperature should be established and maintained in and for definite lengths of time irrespective of the position of the rheostat lever.

The factor next in importance is the accurate adjustment of the pyrometer indicator. This should be made by firing samples of high fusing porcelain after a definite technic and the indicator set when the maximum firing temperature has been established for the particular porcelain used. If S. S. White H. F., Justi H. F. or Dentsply porcelain is used for this adjustment, the indicator can be set at 2400 degrees and should always be kept in that adjustment. That will then be the glazing temperature for any one of these three porcelains, the glazing time depending on the degree of vitrification produced by previous firings, if any.

When the glazing or maximum temperature is thus established, it is much easier to establish definite temperatures at which the other physical changes occur, such as the beginning of vitrification, the low carving biscuit, the high biscuit where shrinkage is practically complete and the still higher degree of vitrification at which stage the porcelain is in best condition for grinding, if and when grinding is necessary before the final glazing.

Before firing, the furnace should be heated to maximum firing temperature and allowed to cool; otherwise, the muffle may not heat so rapidly as is nec-

essary and the work will be overfired. There is no necessity for beginning firing in a cold furnace since the mechanical and hygroscopic water can be driven off without harming the work if it is placed on the apron of the furnace in front of the open door. From two to three minutes is sufficient time for this drying out process. Cracks and checks that are sometimes attributed to a too rapid dehydration are usually the result of insufficient condensation or failure to relieve one of the forces of shrinkage.

In the next period of firing, the organic material burns off and the oxidation of fluxes takes place, liberating carbon dioxide and other gases. The temperature for the beginning of this period, or the maximum temperature at which the work is placed in the muffle, should be at least 300 degrees below the temperature at which vitrification begins, a few minutes being allowed for volitalization to take place.

When the temperature has increased to the point at which vitrification begins, the timing clock should be set and the increase in temperature controlled until vitrification is complete. The rate of 50 degrees per minutes is slow enough for all practical purposes, since dental pieces are so small. This, of course, would not be true if we were dealing with denser clay bodies of larger dimension, which obviously must be fired very slowly.

The texture is best and the strength of porcelain greatest at the point where vitrification is complete. We necessarily sacrifice both texture and strength in order to produce translucency and a glazed surface. At the beginning of the holding, or final firing period, the pores or blebs are of minimum size and number. As the glazing stage is approached, the blebs increase, a more vesicular structure resulting, with a decrease in strength. Overfired porcelain is weak and porous, owing to a continuation of this physical change.

Unfortunately, there is another factor in the construction of porcelain restorations that requires a sacrifice of strength and texture: the necessity of repeated firings. Dental porcelain is of best quality and strength when it is fired but once. Repeated firings promote a further dissociation of feldspar, with a resulting increase in the size and the number of blebs. Fluxed porcelains will withstand repeated firings better than nonfluxed materials. The eutectic combinations in fluxed materials seem to be less susceptible to further dissociation than is feldspar when used alone as the fluxing agent. There is no denying the fact that all porcelains show a poorer vesicular structure after a second firing. These facts should govern the procedure when it is possible and feasible. In the porcelain inlay, the substructure is not so important and the final porcelain applied can easily be fired to a glaze in one firing. Methods for constructing jacket crowns that require the least number of firings are preferable.

By the use of two porcelains having different firing temperatures, it is possible to construct a jacket crown, the bulk of which is subjected to high temperature but once. The crown is built to full contour directly to the matrix, ditched at the shoulder if not previously painted with shellac and fired to the desired glaze in one firing. The ditch is then filled with medium fusing porcelain or one that fires at a temperature from 200 to 250 degrees lower. After firing, this additional porcelain may be ground flush with the shoulder, and then glazed, without injury to the higher fusing material. In this method, the quality can be further improved if the initial firing is arrested just before a full glaze is reached. The final luster can after-

wards be secured by polishing on a lathe with a wet rag wheel and pumice or silica. It is preferable to use a nonfluxed material for the construction of crowns by this method since it has a narrower range of vitrification and, consequently, its subjection to lower temperatures will have no apparent effect on its structure.

Any porcelain crowns, etc., that can be made in one firing or the equivalent of one firing will exhibit a much better structure. If the powder is mixed and condensed well, the finished product should be of such density and quality that a ground surface can be polished to a beautiful finish without the necessity of reglazing.

PLAIN AND HIGH LABIAL ARCHES AS CORRECTIVE AGENTS IN THE TREATMENT OF MALOCCLUSION*

By JAMES W. FORD, D.D.S., Chicago, Ill.

WITH all the appliances in use today, it may be a little difficult to confine ourselves to one appliance in the consideration of treatment. Yet this should not be true, since I think we can all agree that the fundamental principles in all orthodontic treatment are involved in the use of the plain alinement arch. We have heard many men who have practiced orthodontia for many years speak of the satisfactory results which they obtained when they had practically no other appliance. Therefore, it may be well not to get too far away from it, and to consider again its many advantages. No appliance is perfect and, in pointing out the advantages of the plain alinement arch, various applications will be discussed.

In the movement of teeth, we may apply some of the principles which we learned in college, in the construction of bridgework. In general, a missing tooth was always supported by two teeth, and while there may be some partial exceptions to this, the abutments were always sufficiently strong or the bridge would soon be displaced. In orthodontia, this is referred to as anchorage. If one or more teeth are to be moved, there must be sufficient anchorage obtained on approximating teeth to offset the forces applied on the teeth to be moved. Simple, stationary, reciprocal and intermaxillary anchorage will be referred to later.

In previous presentations by Dr. Lischer and Dr. McCoy, we were told of the importance of both the study of the etiology and the diagnosis of every case presented. Great care should be taken in this analysis, as it will have a great bearing on the procedure in treatment and ultimate success in retention and permanent results.

When we have finally come to a conclusion as to the type of appliance to be constructed, it may be well to stress for a moment the kind of materials used and the methods followed in the construction of secure anchor bands.

While today some men seem to be having a fair degree of success in the use of stainless steel, the generally accepted materials are the alloys of gold, platinum

*Read at the Seventieth Midwinter Clinic of the Chicago Dental Society, Feb. 28, 1934.

and palladium, which make for all the generally accepted qualifications of a properly constructed orthodontic appli-

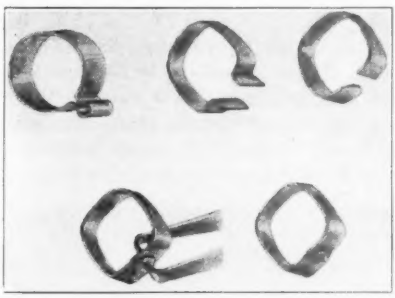


Fig. 1.—Steps in making lap joint molar band.

After a Johnson seamless band or ordinary banding material of the proper gage and width is pinched about the tooth to be banded, the ends are burnished against heavy flat nosed pliers. (Fig. 1.) One side of the pinch is cut off with a straight crown and bridge scissors, and the other side cut off at a bevel from each outer edge of the band, a triangular lap remaining to be soldered to the opposite side. Such a joint will withstand repeated heat treatment without coming unsoldered in soldering tubes or other attachments. In fitting the band, it is assumed that proper separation has been gained to drive the band beyond the contact point and that it has

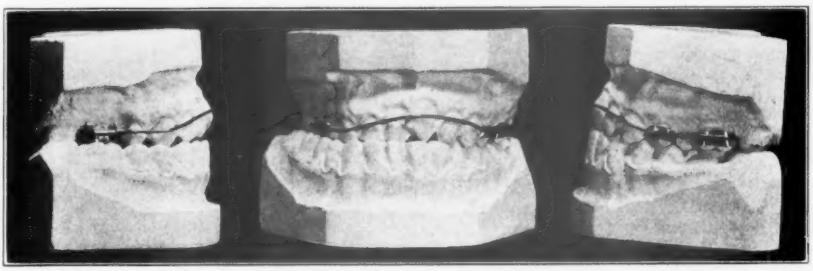


Fig. 2.—Neutroclusion case, with upper right side in lingoversion and second bicuspid impacted; showing labial appliance used for correction.

ance, namely, strength, cleanliness and permanency and, last, but not least, the properties necessary for the distribution of force in manipulation. In order to acquire the properties which the materials possess, the appliances must be so constructed as to attain these properties in their application.

Figure 1 shows a method of making a molar band with a lap joint. Pinched bands are commonly used. Seamless bands, which are used by many, when properly made cannot be improved on. This technic is given as an improvement over the use of the pinch band and can be employed with about an equal amount of effort.

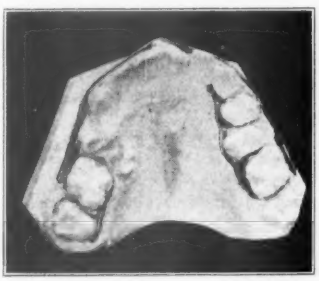


Fig. 3.—Lingual view of appliance shown in Figure 2.

been properly festooned at the gingival aspect, not to impinge on the soft tissues. The occlusal aspect must also be

trimmed, so the band will not interfere with the occlusion of the teeth of the opposite arch. This is often the cause of the loosening of an otherwise properly fitted band.

In considering the outward manifestations of malocclusion, in diagnosis, we likewise consider the possible effect on the underlying structures. Only mention of the necessity of the roentgenogram in this regard is necessary. A malocclusion exists in which disturbed function and malrelation of anatomic structures is present. In the application of corrective measures, constant study is necessary, so that, in tooth movement, these structures may at all times be maintained in a healthy condition, and when the outward functional and anatomic relationships are corrected, the underlying structures progress to their normal for permanent retention. A thorough understanding of the tissue changes occurring during this operation is most necessary.

In constructing an orthodontic appliance, then, it is quite evident that, for safety, too many tooth movements, singly or in groups, should not be attempted at one time, and that it is in most cases impossible to construct a complete operating appliance at the beginning of treatment which will serve without modification or addition as certain steps are completed or new conditions arise.

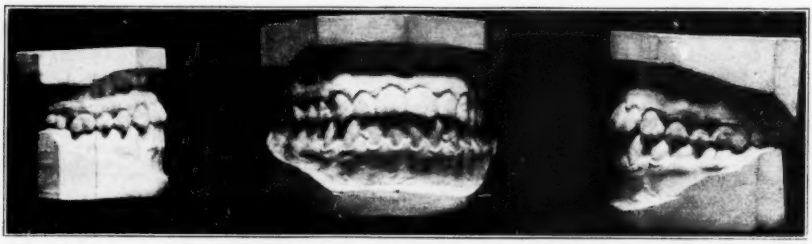


Fig. 4.—Result of treatment of case shown in Figures 2-3.

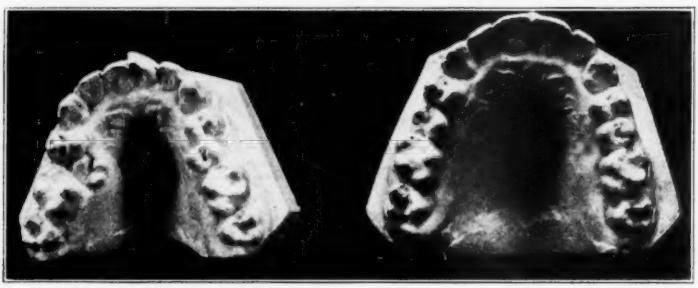


Fig. 5.—Occlusal view of maxillary arch of case shown in Figures 2-4; before and after treatment.

With this thought, the following cases are presented for your consideration.

Figure 2 shows a neutroclusion case with the upper right side in lingoversion and upper right second maxillary bicuspid impacted.

In Figure 3, a stationary anchorage is placed on the upper left first maxillary

bicuspid and first permanent molar, with a lingual attachment soldered to each. To further stabilize this stationary anchorage, a flat tube with threaded end is used on the upper left first maxillary molar and a McCoy open tube on the upper left first maxillary bicuspid, a 0.030 alinement arch wire with threaded ends engaging a round tube on the upper right first maxillary second molar, which has a lingual extension to the second molar.

Figure 6 shows a neutroclusion case in which the upper left side is mesiad from the normal, a malocclusion of the upper anterior teeth resulting.

In Figure 7 is shown a stationary anchorage constructed on the mandibular first molars with a soldered lingual arch. Buccal tubes are soldered in position to be used later with a labial alinement arch, to give better contour to the mandibular arch. The left tube is used in

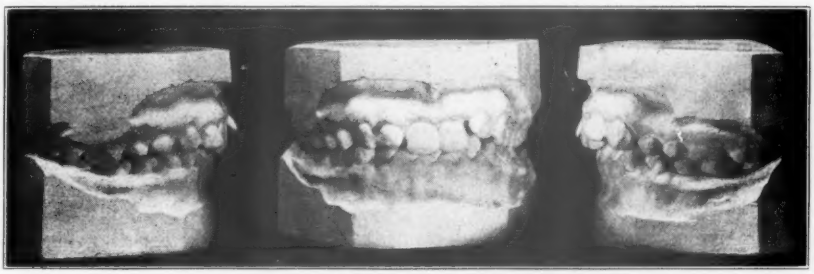


Fig. 6.—Neutroclusion case, upper left side being mesiad from normal.

When the appliance is operated, the lingual extension to the second molar should not rest against the second molar until the first molar begins to respond. After the molars are moved slightly, the teeth mesiad from them in lingoversion may be ligated to the arch, the operator at all times being careful not to overstrain the stationary anchorage on the upper left side. When this has been accomplished, means for opening the space for the second bicuspid and ligating it into position and rotating the central incisors can be applied. Finally, the lingual stationary arch wire on the upper left side should be cut out to ligate the upper left second maxillary bicuspid in position.

Figure 4 shows the result of the treatment.

Figure 5 is an occlusal view of the maxillary arch before and after treatment.

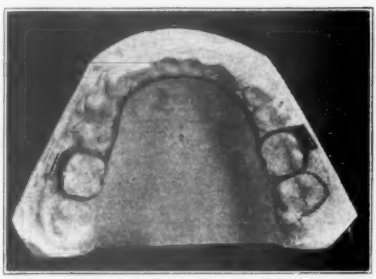


Fig. 7.—Stationary anchorage constructed on mandibular first molars with soldered lingual arch.

the first step of treatment as an intermaxillary hook.

Figure 8 shows the maxillary labial alinement arch placed in the ordinary manner on the central incisors and first molars, McCoy tubes being used on the former. On the left side, a coil spring is employed against the first maxillary

molar, as used by Drs. Arnold and Johnson, and an intermaxillary hook is soldered on the upper distal aspect to the cuspid, for the intermaxillary elastic. Added advantage in tipping this molar back into position can be had in applying the principle of Dr. Angle by bending the distal end of the arch gingivally before inserting it in the buccal tube, gaining additional tipping force distally along with the intermaxillary elastic force and force of the coil spring mesiad from the molar tube.

Figure 11 shows a stationary anchorage constructed on the maxillary first molars with a soldered lingual arch and buccal tubes on the first molar bands.

In Figure 12, the four maxillary anterior teeth are banded with McCoy open tubes on the labial aspect. A 0.030 alinement arch is used on the anterior teeth, back to the mesial aspect of the first deciduous molars, being continued

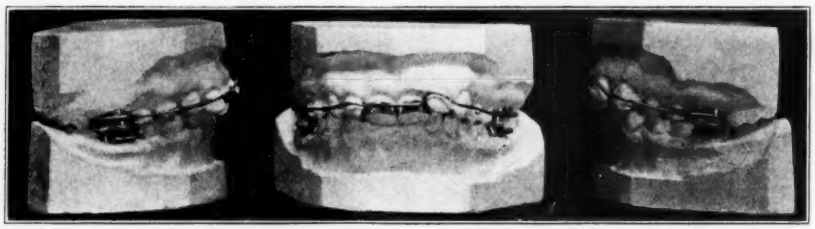


Fig. 8.—Maxillary labial appliance in place used in treatment of case shown in Figure 6.

Fig. 9.—Result of treatment of case shown in Figures 6 and 8.

When this has been accomplished, another problem presents itself, depending on the position of the teeth, in getting the other remaining maloccluding teeth in position. The case so far demonstrates the use of stationary intermaxillary anchorage.

Figure 9 shows the results of treatment.

Figure 10 shows a neutroclusion case involving a tongue habit, resulting in an open bite condition, something to be considered in etiology.

through the buccal tubes with a 0.036 or 19 gage wire. Vertical pin extensions are soldered on the alinement arch to extend occlusally on to the labial aspect of the incisors, toward the occlusal edge, to control their apical movement, as they are carried down into the line of occlusion. In bringing the anterior teeth down into occlusion against one another, we have reciprocal anchorage of each anterior tooth to the other, and in using the

heavier alinement arch, distad from the first deciduous molars, we have reinforced anchorage of each side to the other, against the stationary anchorage of the first molars.

As this case has just been placed under treatment, there are no results to present.

Figure 13 shows a method of soldering a McCoy open tube in place, on to the labial surface of an anterior band. A 0.030 wire is bent in the shape of an oblong, about ½ by 1 inch, with one of

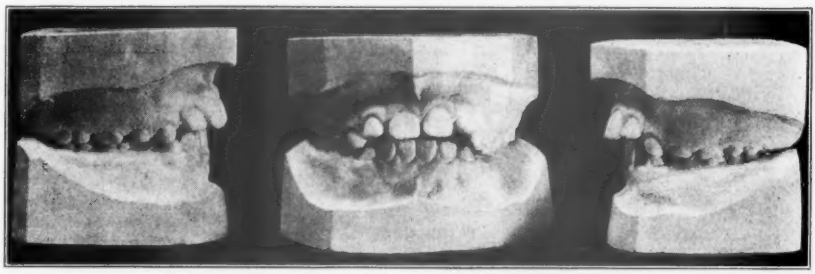


Fig. 10.—Neutroclusion case involving tongue habit resulting in an open bite.

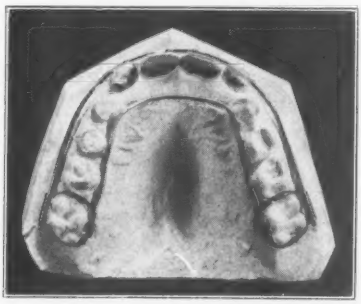


Fig. 11.—Stationary anchorage constructed on maxillary first molars of case shown in Figure 10, with a soldered lingual arch.

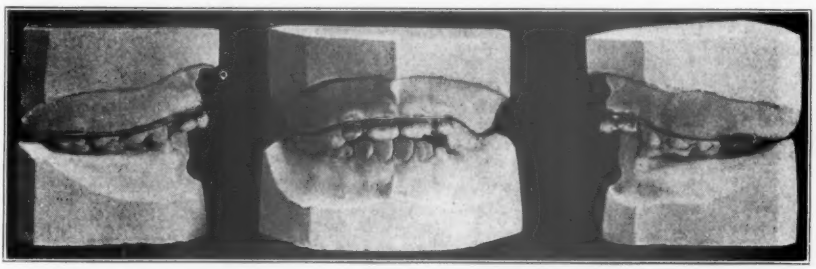


Fig. 12.—Upper labial appliance in place; used in treatment of case shown in Figure 10.

the narrow ends open, these ends being bent at right angles to the long side of the oblong to be inserted in a charcoal block. The open ends of the oblong are inserted in the block, so that the closed end will be parallel to the edge of the block. The band can be inserted in the edge of the block under this part of the wire and the McCoy tube placed on the wire and held in the position determined on, to be soldered to the band. A half round closed tube, in the use of lingual arches, can be held in position in a similar manner, except that it is not placed on the wire.

Figure 14 is a neutroclusion case of a mixed denture in which it is necessary to restore normal arch form.

mesial aspect of the deciduous cuspids except on the lower left side, where it is not present and the extension terminates at the

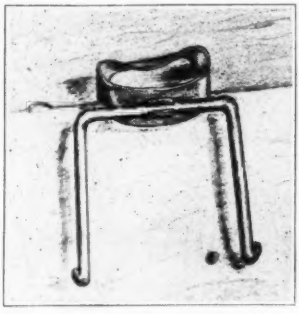


Fig. 13.—Method of soldering McCoy open tube on to labial surface of anterior band.

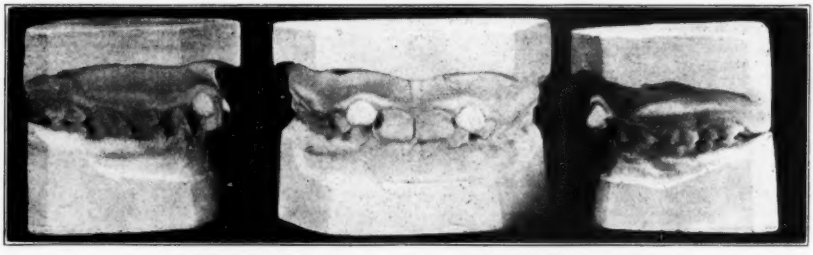


Fig. 14.—Neutroclusion case of mixed denture, in which it is necessary to restore normal arch form.

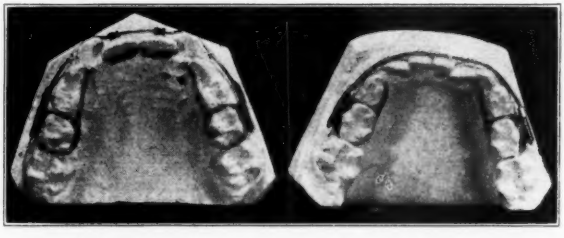


Fig. 15.—Lingual view of appliances used in treatment of case shown in Figure 14.

In Figure 15, the anchor bands are placed on all the second deciduous molars with lingual extensions soldered onto the molar bands extending to the mesial aspect of the first deciduous molar. This illustrates reinforced reciprocal anchorage in expansion and for carrying the anterior teeth forward. Two meth-

ods of ligating this lingual extension are shown. On the lower, they are ligated around the first deciduous molars to the alinement arch, and on the upper, spurs are soldered on the ends of the extensions and on the alinement arch opposite these spurs to secure the ligature in ligating. Reasons for either procedure may arise in operations to obtain security.

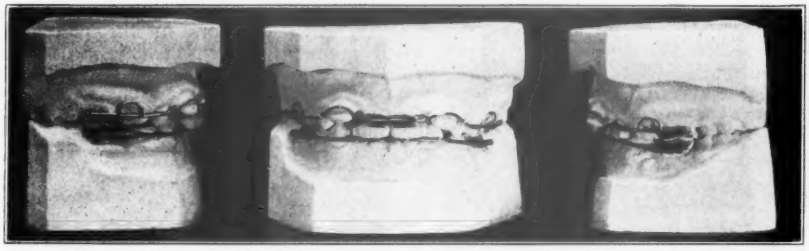


Fig. 16.—Labial views of appliances used in treatment of case shown in Figure 14.

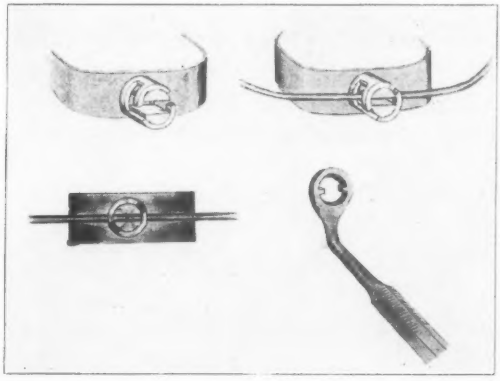


Fig. 17.—Type of lock for engagement of alinement arch on maxillary central incisors in case shown in Figures 14-16.

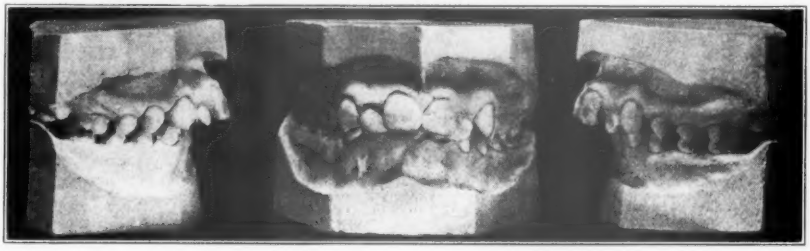


Fig. 18.—Distoclusion case, commonly known as Class II, Type 1 malocclusion.

In Figure 16, bands are placed on the

upper central incisors with a new type locking device for the engagement of a 0.030 alinement wire. The lower anterior teeth are ligated to the alinement arch with silk or fine stainless steel wire.

Since this case is also under treatment, the result cannot be presented.

Figure 17 shows the type of lock for the engagement of the alinement arch on the central incisors in the preceding case. It comes attached to the banding material and is operated by the wrench key shown.

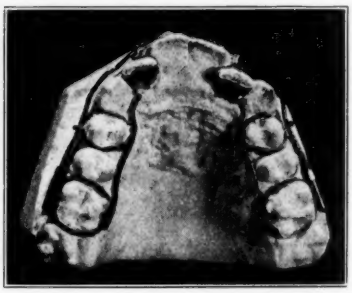


Fig. 19.—Lingual view of upper appliance used in treatment of case shown in Figure 18.

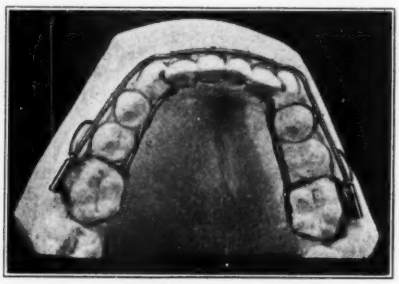


Fig. 20.—Lingual view of lower appliance used in treatment of case shown in Figure 18.

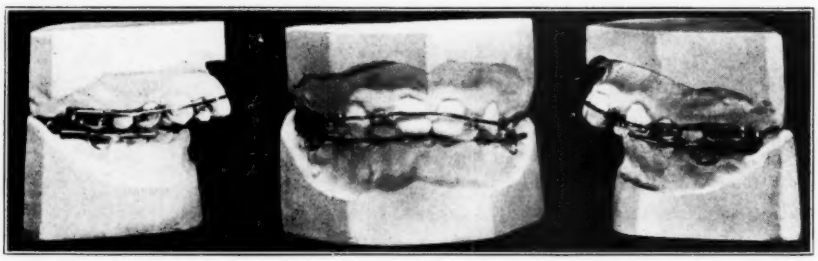


Fig. 21.—Labial views of appliances used in treatment of case shown in Figure 18.

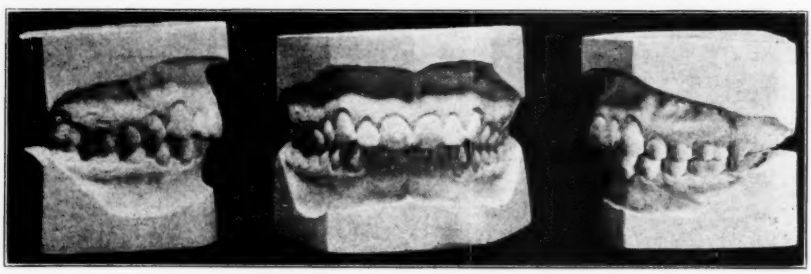


Fig. 22.—Result of treatment of case shown in Figure 18.

The methods of application of force on both the upper and lower anterior teeth illustrate simple anchorage.

Figure 18 shows a distoclusion case, commonly known as Class II Type 1 malocclusion.

In Figure 19, on the upper first bicuspids and first molars, a type of anchorage has been placed which can be used to great advantage in many cases. The two bands on the first bicuspids and molars control the expansion of each side of the arch, including the cuspids to the first molars, as well as prevent tipping of the molars. In some cases, tipping would be an advantage and such an anchorage would be contraindicated. Tubes are soldered on the lingual aspect of the molars and a 0.030 wire soldered to the

Fig. 23.—Third molar impactions in case shown in Figures 18-22.

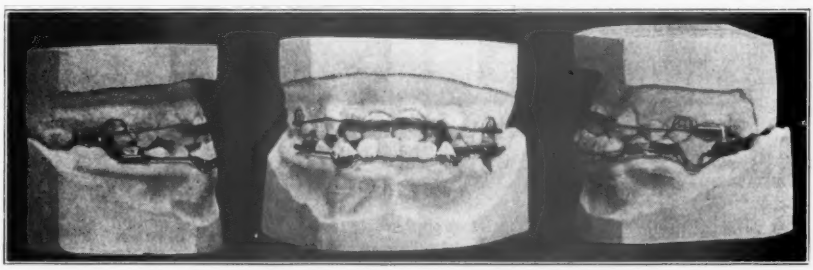


Fig. 24.—Subdivision of Class III case; showing labial views of appliances used in treatment.

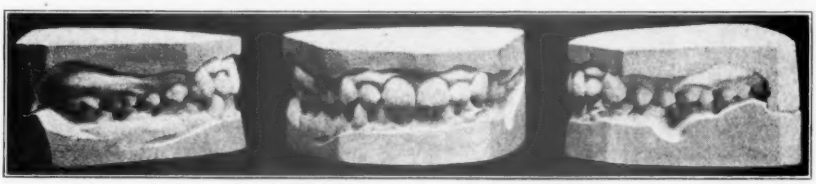


Fig. 25.—Result obtained in treatment of preceding case.

lingual aspect of the first bicuspids, to extend mesially to the cuspids and distally through the tubes on the molars. On the maxillary lateral incisors, bands are placed for rotation and to extend to the labial arch. As illustrated, two hooks are placed on the lingual aspect, to gain extra force and control in rotating the lateral incisors.

In Figure 20, on the lower teeth, the usual appliance with bands on the first molars and lingual extensions soldered to the lingual aspect of the molar bands,

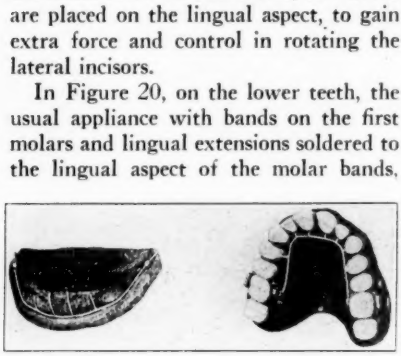


Fig. 26.—High labial arch as first used for retention by Dr. Lourie. (Courtesy of Dr. Lourie.)

Fig. 27.—High labial arch and plaster block, high labial arch to be adjusted for retention by the patient by means of elastics. (Courtesy of Dr. Lourie.)

extending to the cuspids, are used with the ordinary alinement arch.

Figure 21 shows ordinary labial alinement arches placed on the upper and lower teeth with intermaxillary hooks on the upper distal aspect to the cuspids for intermaxillary elastics. Ketcham hooks were placed on the buccal aspect of the maxillary bicuspids for the reception of the labial arch. Threaded ends with nuts were placed on the upper teeth and vertical loops were placed on the lower to rest against the mesial aspect of the molar tubes; which is a matter of choice.

When the arch form was well under way, intermaxillary elastics were used, showing the use of intermaxillary anchorage.

In Figure 22, while all the treatment of the case was not carried out in just the manner given, most of it was, and the result is shown.

On completion of the case, shown in Figure 23, the third molars were roentgenographed and all were found to be

Fig. 28.—High labial arch in position.

impacted. The patient is now 16 years of age and, to prevent collapse of the case, all third molars must be removed before retention is discontinued.

Figure 24 shows a subdivision of a Class III case with a complete mesial relation on the right side and a lingoversion of the right maxillary first molar. This is a mutilated case, with loss of the lower left first molar and rotation of the left second molar.

On the upper teeth, bands are placed on the four anterior teeth and first molars, with McCoy open tubes on the

anterior teeth. Vertical pin extensions are soldered on the alinement arch to extend occlusal on to the labial aspect of the incisors, to gain bodily movement. The first requirement in the operation of this upper appliance is to gain arch form by bringing the right molar buccally and the four anterior teeth mesially. Finger springs are used on the lateral incisors to carry them to the arch.

On the lower teeth, the cuspids and left first and second bicuspids and first molars are banded, with McCoy open tubes on the anterior teeth. The case can be started by using an ordinary 0.030 alinement arch with a vertical loop in the space left by the removal of the lower first molar. With the additional anchorage by banding the first and second bicuspids with a stop soldered on the alinement arch, distad from the tube on the second bicuspid, the lower left second molar can be rotated to position. This method of caring for the second molar is described by Dr. Strang in his new book in conjunction with the use of the edgewise labial arch. Probably, as treatment progressed in this case, it would be necessary to band the lower four anterior teeth with vertical extensions on the alinement arch, to the gingival aspect, to prevent tipping. This, as the previous case, is an example of intermaxillary anchorage.

Figure 25 shows the result obtained. It was the ambition of the operator to close the mandibular left first molar space, carrying the second molar forward, an operation which was not completed and which he probably would not decide to attempt at the present time.

CONCLUSION

May it be suggested, as we stated in the beginning, that the plain alinement arch as a corrective agent in malocclusion is something not to be discarded and, further, that, in any treatment, when in doubt, it may best be applied until something better can be decided on.

THE LOURIE HIGH LABIAL ARCH

Dr. Lourie had a number of patients who were going out of the city for some time during the summer and thought it would be well to adjust the alinement arch so that it would not be so conspicuous and, at the same time, would be easier to keep clean and not be in apposition to the anterior teeth, for prophylactic reasons. In a number of patients, he adjusted the arches above the gingival border and soldered wire extensions, which we now call finger springs, to the arch to rest on the teeth that he was most concerned in retaining. He used this appliance in combination with a lingual arch. After he had been following this practice for some time with great success, he was called on to give a clinic before the American Society of Orthodontists at Toronto, in July, 1914, and concluded to give a clinic on the use of the lingual and high labial arches as used in retention. In this clinic, he pointed out the advantages of avoiding the use of bands which took up valuable space at interproximal contacts and were an element of danger to tooth structure. He further emphasized that it was less conspicuous and demonstrated how it may be worn only at night for secondary retention.

Figures 26 and 27 illustrate the points mentioned. In Figure 26, the appliance is placed as a fixed retainer. In Figure 27, it may be adjusted by the patient by means of elastics. When not worn, it was to be placed on the plaster block, so that the patient might know whether it had become distorted, distortion resulting in maladjustment in position in the mouth.

On the further use of this appliance, Lourie observed that teeth were sometimes moved by these wire extensions or

finger springs after the patient's being away for periods of time. He quickly concluded that a little too much pressure of these finger springs moved teeth and immediately took advantage of his findings in practice. The use of the high labial arch in orthodontic treatment was the result. He gave his first paper on its use in treatment before the American Society of Orthodontists in September, 1917. In this paper, he stressed the possibility of individual tooth movement without undesirable reaction on adjoining teeth and with the minimum reaction on anchor teeth, the base wire absorbing much of this reaction and therefore acting as an anchorage.

This, I think, tells in detail, though somewhat briefly, the principles and advantages of the use of the high labial arch.

Figure 28 shows the high labial arch. Four anterior finger springs are in position with intermaxillary hooks on each side distad from the cuspids.

SUMMARY

The use of a heavy base wire, preferably 17 gage, is essential, except when used on bicuspids, where 19 gage may be used.

Stabilization of the arch on two teeth anterior to the molars is sought.

Fine finger springs are used, preferably 23 or 24 gage.

In the operation of the appliance, there are the following advantages: the use of fewer bands, individual tooth movement, simplification of anchorage and in operation, modification of the appliance at the operator's convenience.

55 East Washington Street.

CONSERVATION OF THE EDENTULOUS ALVEOLAR PROCESS*

By MELVIN E. PAGE, D.D.S., Muskegon, Mich.

IT has been taken for granted by the profession and to a great extent by prosthetic specialists that prosthetic restorations at their best are comparatively short lived. Not that the dentures themselves were fragile and temporary, but that their foundations, the underlying bony processes, were bound to shrink and disappear in the course of time, necessitating the construction of new dentures at frequent intervals or the rebasing of the old ones.

Nevertheless, I am convinced that with the information gathered by workers in the various phases and specialties of both dentistry and medicine and in its coordination and application to the individual patient, a great deal can be done to prevent the rapidity of this absorption of alveolar process and its attendant evils, or to check it.

Such a correlation of the knowledge and experience of numerous writers and clinicians, with a very little of my own tending to show that such an objective is feasible, together with a procedure to secure such results, is the object of this paper.

The evils of alveolar absorption are

*Read before the National Society of Denture Prosthetists, St. Paul, Minn., Aug. 3, 1934.

well known. Of what value the effort required to make the finest set of dentures if the supporting structures, the very foundations upon which we build, change in size, shape and relative position? If the foundation changes, the functioning of the dentures becomes in a great measure lost. The dentures no longer have the ability to maintain balance under stress; even the centric relation becomes changed, malocclusion of the dentures, which, in turn, increases the rate of change in the process, resulting. A wearer of such dentures is doomed to discomfort, ill health and a lesser portion of happiness than he might rightfully expect. To correct this condition, we must understand the causes of alveolar absorption. They may be classified under three heads: (1) lack of stimuli; (2) irritation; (3) systemic conditions. 1. Lack of proper stimuli is illustrated in areas where teeth have been previously removed. Such areas are very commonly seen. The roentgenogram reveals much absorption of these areas; while the neighboring process around teeth which are being used in mastication retains its former position, or nearly so. 2. Irritation can be classified as mechanical, chemical and thermal.

The proper use of tissue acts as a stimulating force. Improper use, such as that exerted by improperly balanced dentures, causes trauma to the underlying tissue. If dentures do not balance in right and left lateral excursions, the traumatized tissue will be practically all of that underlying the dentures. We often see absorption of the anterior portion of the ridges due to insufficient anterior clearance and protrusive balance. These conditions, which are, unfortunately, more often seen in the mouths of denture wearers than not, illustrate the mechanical phases of irritation.

The materials of which some dentures are composed contribute to the chemical phases of irritation by direct means such as the formation of poisonous salts by the contact of some metals with saliva or with ingested fruit acids, or by indirect means, such as the use of porous materials, in which bacteria eventually thrive and produce toxins.

The thermal irritation comes rather from the lack of thermal stimuli to the tissue underlying nonconducting materials.

Practically all the literature on the conservation of the alveolar process deals with the subject from the standpoint of trauma; that is, the mechanical perfection of the dentures as regards fit, balance and tissue tolerance. Still another means of helping to conserve the process which has not been so well touched on is the treatment and correction of the systemic condition of the patient.

We know that the alveolar process is similar to bone and, like bone, responds to the laws of nourishment. We do mark this difference: the process may be lost under certain systemic conditions which apparently affect the other body tissues but slightly.

We also know that teeth and bone respond to the same systemic conditions, the difference being only in the degree to which they respond. We will not be far astray in assuming that, in general, the alveolar process is subject to the same laws as are the other bony tissues, including the teeth.

The work of McCollum, Price, Hawkins and many others on diet and mineral metabolism has not only done much to make caries avoidable, but has also thrown light on subjects not usually considered in the province of the dentist, but in which the profession is finding more and more interest.

The profession of dentistry started out as a craft, concerned with the mechanical

repair and replacement of missing teeth, and gradually grew to include the medical treatment of oral lesions, but, in so doing, found its field broadening, as one part of the body cannot be considered a separate entity from the rest of the body. In the mouth is found both the causes and the results of pathologic conditions elsewhere. The trend is clear. The dentist must have as much medical education as the rhinologist, the pediatrician, the gynecologist or any other specialist of medicine. Likewise, the prosthodontist must consider not only the mechanical problems of denture construction, but also the effect of the prosthesis on the patient and the effect of the patient on the prosthesis.

I find that immunity or the lack of immunity to caries in patients 18 years of age or over can be determined by the analysis of the blood for calcium and phosphorus. To be immune, the product of the serum, calcium and phosphorus, in milligrams per hundred cubic centimeters of blood must be 40 or above, and the calcium and phosphorus must be in proper proportion or balance. Price, Crile and others have also found that when this condition exists, fractured long bones unite and heal rapidly and that when a low content of calcium and phosphorus or an imbalance is found in the blood, fractures are slow to heal, even to the point where union is impossible. It has been found also that the long bones will shrink in size if the blood mineral content persists in being low or in imbalance for long periods of time, such as in the aged. A shortening of stature of as much as 5 inches has been noted.

The same condition affects the stability of the alveolar process. Nearly every dentist who has practiced any length of time has noted a wide range in the stability of the alveolar process under full and partial dentures. In the large majority of patients, this stability is negligible, but, in some cases, rather rare it is true, the process stays stable for long periods of time. The best example of this of which I am cognizant was in a man who had worn the same gold based denture for forty years without evidence of shrinkage of the underlying process. We all know that if there had been loss of process, the ridges would have been composed of soft tissue or there would not have been adequate retention of the denture. Two other cases even more convincing come to mind. In both, partial dentures had been made in England about thirty-five years ago. They were of swaged silver, each consisting of two soldered layers. The replaced teeth were fitted between adjacent teeth without occlusal rests and were in occlusion with natural teeth. In most cases of this kind, the handle of a mouth-mirror or explorer can be inserted between the teeth of the denture and the opposing teeth and the patient can still bring the opposing natural teeth together; but, in these cases, the denture teeth had as much bearing as the natural ones. One partial denture had been worn about eighteen years and the other twenty-five.

I have also seen cases wherein vulcanite dentures had been worn a long time without apparent shrinkage; but although in the past there have been more vulcanite dentures made than metal, it is rarer to find stable cases which have been worn any great length of time. Occasionally, I have seen full upper and lower dentures of which the upper has remained stable, but the lower has not, showing the ravages of mechanical trauma accumulating to the greater degree in the less stable denture and in the one having the lesser bearing surface.

The problem before us is to make it possible to produce this stable condition of the process in other patients; in pa-

tients in whom, under prevailing practice, the dentures would remain stable but a very short time.

I have found this entirely possible provided we have the cooperation of the patient.

When the ridges undergo continuous absorption, there is no comfort or efficiency with dentures possible to any great extent, and likewise the health of the patient is impaired. Such a condition necessitates continual rebasing of the dentures, or new dentures; or, if this is not done, loss of vertical distance develops, with its attendant loss of esthetic values and efficiency. Also, the hearing may be affected; a condition named by Wright "traumatic deafness." This absorption also indicates a systemic condition of mineral metabolism which has deleterious effects on the patient. Such a person is susceptible to infection, to fractures and to other pathologic processes owing to the disturbed mineral metabolism.

Before extraction, the patient should be informed as to the results which are desired, and the procedure necessary to obtain them. If cooperation can be obtained, it is my practice to name a fee for the whole procedure, which includes roentgenograms, extraction, temporary dentures and relining and the permanent dentures, besides the cost of two or three blood analyses. Thus, the patient is more likely to have the whole service; which I believe to be for his best interest.

Surgical operations of the mouth must be performed with the double purpose of conserving as much of the process as possible and of preparing a suitable foundation for dentures.

We have all seen the results of radical alveolotomy and the subsequent crippling of the mouth, unfitting it for a foundation for dentures. Fortunately, that era has passed; but we do see the majority of mouths undergoing operations on which more care might be exercised for the future well being of the patient.

It is well to remember that as much healthy process must be retained as possible and that bone cannot be developed to a greater height than the surrounding periosteum can be healthfully supported. Suturing of flaps demands careful consideration of the suture angle and the tension, to so support the periosteum as to prevent sagging. This does not mean that suitable trimming of the process is contra-indicated. It is indicated to a degree in practically all cases. A mean level of the ridge should be obtained and those points and spicules of the ridge extending beyond this level should be trimmed off, but this level should be as high as can be procured and maintained long enough for a cortical layer to develop.

While this cortical layer is developing, there can be no real stability of the alveolar process, and immediate temporary dentures, built in such a way that the minimum of pressure is required to masticate food, should be inserted.

To obtain this result, the occlusal surfaces of the posterior teeth should have a greatly lessened area with rather wide embrasures or escapements for food. As there is bound to be some settling or shrinkage of the underlying process, shallow cusp or nonanatomic posterior teeth should be used to avoid trauma incidental to the changed anteroposterior relation of the dentures.

The dentures should also be constructed of some material readily relined. While such dentures may not be very efficient, they suffice until the mouth is ready for the permanent dentures and serve in a fair measure not only to masticate food, but to continue use of the muscles of mastication while maintaining the appearance and the vertical distance.

Systemic treatment is advisable in nearly all denture cases. The patient

usually loses his teeth because of a disturbed mineral metabolism and will likewise lose the ridges if this condition is not rectified.

The first blood test is made as soon as possible after the course to be pursued is decided on; and if the calcium and phosphorus product is low or an imbalance is present, or both, steps are taken to rectify it.

The ordinary American adult diet in the northern states contains a sufficiency of calcium and phosphorus; but if on inquiry this is not found to be true of the individual patient, the diet is rectified. A common deficiency in the northern states is that of vitamin D. City dwellers do not as a rule venture out doors any more than is necessary in the winter months, which are seven or eight of the twelve, and when they do, it is mostly in glass enclosed cars. Such a mode of living creates a general deficiency in the sun-given vitamin D, which controls the assimilation and balance of the two bone and tooth important minerals.

In some parts of the south, it is a lack of calcium and other minerals in the soil that in turn causes a lack of these elements in the food, malnutrition of the hard tissues rather than lack of vitamin D resulting.

Other vitamins have been found to play a part in bone building and maintenance. These are vitamins A and C. But these can readily be supplied in the modern diet with almost the same ease and facility in the north as in the south, owing to the marvels of modern transportation.

Usually, the addition of cod liver oil to the diet will increase the mineral content of the blood to the desired point and maintain the desired balance. A second blood test will tell the story. It is usually taken four or five weeks after the first. If the blood pictures are as they should be, the patient has learned his lesson and has had it forcefully demonstrated to him that the well being of his mouth depends on himself.

There are some cases which do not show this desired improvement in the calcium-phosphorus content of the blood. In such cases, a metabolism test is indicated. There are five endocrine glands which are known to have much to do with mineral metabolism: the thyroid, parathyroids, ovaries, hypophysis and thymus.

The thyroid seems to be the most important gland, as it more or less influences the others. When we find, by the metabolism test, that there is dysfunction of the thyroid, treatment at present lies with it. It is possible that the dysfunction of the thyroid is due to its effort to counterbalance a dysfunction of some other endocrine gland, but as far as my experience goes, treatment of the thyroid seems to assure the desired results.

In the Great Lakes basin, dysfunction of the thyroid is very prevalent. The condition may evidence itself either in hyperfunction or hypofunction. Hyperfunction is easily recognized and nearly all of the literature on thyroid dysfunction deals with this phase. A condition not so generally recognized is hypofunction of the thyroid. In Michigan, where I have been investigating thyroid dysfunction in its relation to teeth and process, it has been difficult to find patients not affected in this manner. The percentage of hypothyroidism is very high. I believe, from what opportunity I have had to examine patients from other parts of the country, that this condition is not confined to the states bordering the Great Lakes, but exists to greater or lesser degree throughout the country.

This condition of dysfunction of the thyroid is supposed to be due to lack of iodine in the food. Attempts to rectify

this condition have been made by adding sodium iodide to the drinking water in some large cities and by the use of iodized salt. Goiter is much less prevalent in these cities now than formerly, but the addition of the organic form of iodine rather than the inorganic would, I believe, be more easily assimilated.

Again, I am not so sure that all the blame can be laid to the absence of iodine. There is strong evidence that the lack of minute quantities of manganese in the food tends to lower the metabolism. Also, some forms of anemia affect the metabolism, a condition much improved by the addition of iron and copper to the diet.

The minerals in the soil are all more or less soluble and, in the course of countless centuries, a great deal of those most readily soluble must have been washed from the soil or taken up by plants and not replaced.

Hypothyroidism has a marked effect on the calcium-phosphorus content of the blood. It is usually indicated by a normal calcium content, but with a disproportionate amount of phosphorus. Usually, the phosphorus will be low, but I have seen cases wherein it was higher than normal. In these cases, hypothyroidism is not readily diagnosed as the individual is usually of normal or less than normal weight. Only the determination of the basal metabolic rate serves to classify the condition.

Hypothyroidism is treated by the administration of thyroid extract. So far, I have no record of any patient recovering to the point where the thyroid gland was able to increase its secretion enough that the administration of the thyroid extract became unnecessary. To prevent dysfunction of thyroids in unaffected people, a liberal amount of sea food is recommended. One of the best of these, especially for those living where sea fish are not readily procurable, is kelp. Kelp is a seaweed or leafy vegetable having a high organic mineral content which corrects a more or less general mineral deficiency in an economical manner. Cod liver oil also is procurable almost anywhere and not only contains vitamins A and D, but also is a good source of organic iodine.

Thyroid extract apparently has a similar effect on calcium-phosphorus metabolism as does vitamin D, but one does not displace the other. Both must be present to have the desired effect of maintaining the level and balance of calcium and phosphorus. If not present naturally, they must be administered.

If I can get the calcium-phosphorus content high enough that their product is 40 or above, I do not fear shrinkage of the process, provided a proper balance is also maintained. My experience as to the proper proportion of these elements differs somewhat from that of others. As nearly as I can determine, the phosphorus should be about 40 per cent of the calcium. One case gave a product of 77, the calcium being 11 mg. and the phosphorus 7 mg. This was a case of arthritis with fusion of two of the vertebrae in the lumbar region and a blood pressure of 95 and a metabolic rate of −9. In three months' treatment with one-fourth grain of enteric coated thyroid extract tablets, the calcium-phosphorus product was reduced to 49, the blood pressure raised to 118 and the arthritis relieved.

Another case is interesting in that the first blood test gave a product of 18. The diet was carefully regulated, and, at the end of six weeks, the blood was again tested. The product this time was 16. This patient was about 45 years old and rather stout, but she ate lightly. She stated that it was natural for her to be stout, as all her relatives were. A test was made, and the metabolism found low. Thyroid extract was given and, after a few weeks, dentures were made.

In three years, the vertical distance had not closed perceptibly, although previously, with other dentures, the vertical distance had closed 2 mm. in six weeks. The patient had had five sets of dentures in three years previous to that time.

The administration of small doses of thyroid extract has cleared up the arthritis of several of my patients. We see so many women at the menopause who have pain and swelling of the finger joints or of the knee. Thyroid seems never to fail to help them.

Hypothyroidism may be suspected in people tending to gain weight readily, but some hypothyroid patients are underweight and although −10 to +10 is considered within the normal range in the metabolism test, anything minus can, I find, be helped by a little thyroid extract.

A warning may well be stressed that no patient should be given thyroid extract without consultation with the physician to determine whether such administration might have a deleterious effect. The heart and lungs should be examined by the physician for disease, as, in some cases of heart involvement, continued lessening of the load on it may be advisable, as may lessening of the blood pressure in a case of arrested tuberculosis.

Usually, the patients on thyroid therapy need to take the extract after the metabolism reaches normal. A little experimentation determines the amount necessary to keep the metabolism and blood pressure normal.

After the blood calcium and phosphorus product has been established at 40 or above, and sufficient time has elapsed for the cortical layer of the process to form, it is possible to make the permanent dentures without fear of failure, if the mechanical causes of absorption are avoided in their construction.

The foregoing statements in regard to absorption of the alveolar process and means to use toward overcoming this undesirable condition are not theoretical. The ideal of prevention is just as important in prosthesis as in other branches of dentistry or medicine, and although its principles are applied a little late in the case of the denture patient, his previous experiences make him very receptive.

A few case histories with their corresponding tests for serum calcium and phosphorus follow:

$8.2 \times 3.8 = 31.16$; P = 46.3 per cent: This test was made on an elderly man who had several sets of teeth, none of which were comfortable. His dentist had made repeated efforts to make him comfortable, without success. The story told by the blood test explained the difficulty. Both the calcium and the phosphorus were low, and the proportion of phosphorus to the calcium was high. Cod liver oil was given daily and new metal-based dentures were made. This patient is now comfortable and has sent me another patient just recently for dentures.

$9 \times 3.6 = 32$; P = 40 per cent: This patient appeared with a full upper denture and a partial lower and wanted to know whether the wrinkles about her mouth were due to her dentures or her age. As she had about 6 mm. of absorption, the condition was explained and the procedure necessary to correct it and maintain the correction. It seemed that as the proportions of calcium and phosphorus were correct, but the total was too low, dicalcium phosphate with cod liver oil would bring up the total. This was tried with the following results: $10 \times 3.4 = 34$; P = 34 per cent.

The calcium came up, but the phosphorus dropped slightly. A metabolism test was made with a −2 result. One-tenth grain of thyroid extract with kelp was given to put the phosphorus in correct proportion, the result being in one month: $10 \times 3.8 = 38$; P = 38 per cent.

$11.2 \times 2.4 = 27$; P = 21 per cent: This patient had about half of her teeth left, and came in to have the remainder of them out and dentures constructed. With such a systemic condition as was evidenced by the reading, no dentures could be very successful. The patient was put on cod liver oil, and when her systemic condition showed improvement, the teeth were extracted and immediate temporary dentures constructed.

Another test then showed: $8.5 \times 4.2 = 36$; P = 50 per cent, a 33 per cent improvement in the calcium-phosphorus level; but the imbalance continued. This time the phosphorus was too great in proportion; a condition that is liable to cause arthritis. A metabolism test showed −10. The patient was given one-tenth grain of thyroid and organic minerals in the form of kelp.

$13 \times 3.8 = 49$; P = 29 per cent: This patient came in for new dentures and was tested for calcium and phosphorus. The metabolism was −20. She was given one-half grain of thyroid and kelp, with the following results: $11 \times 4.2 = 46$; P = 38 per cent. This indicates a systemic condition favorable for success with dentures.

$8 \times 3.5 = 28$; P = 44 per cent (March, 1934): The patient had pyorrhea for ten years. Dical phosphate and cod liver oil were given.

$10 \times 3.5 = 35$; P = 35 per cent (April 1934): This showed an improvement in the calcium, but with the addition of kelp the results became: $11 \times 3.9 = 43$; P = 36 per cent; a condition going from susceptibility to immunity to pyorrhea and dental decay in two months.

$11 \times 3.2 = 35$; P = 29 per cent; BP $\frac{120}{70}$ (age, 45): This patient came in for permanent dentures. There being a decided imbalance of calcium and phosphorus and the metabolism being −8, she was given a prescription calling for one-fourth grain thyroid and 4-6 kelp tablets daily. Stress was laid on the necessity for having another blood test in a month.

$10 \times 3.6 = 36$; P = 36 per cent (1933); $10 \times 3.5 = 35$; P = 35 per cent; BP $\frac{104}{62}$ BMR − 3 (age 50) (1934): This patient was given one-tenth grain thyroid and 6 kelp tablets daily. This small dosage of thyroid I believed was all that was necessary as the imbalance was not bad and probably of rather recent occurrence; i.e., within the last few years.

$9 \times 4.4 = 40$; P = 49 per cent; BMR − 14 (age, 21): This patient had arthritis in the lumbar region for two years. He was given one-half grain of thyroid and kelp by his physician. In ten days, he was able to go in swimming.

SUMMARY

Alveolar absorption is due to (1) lack of stimulus; (2) irritation, and (3) systemic conditions. The systemic condition as regards bone is determined both by clinical evidence and by the Benedict test for calcium and phosphorus in the blood serum. The condition of the calcium and phosphorus should be such that their product is 40 or over and the proportion of phosphorus to calcium 40 per cent. These proportions are obtained by dietary measures, of which the most important in our latitude is the addition of vitamin D; by correction of dysfunction of the endocrine system, and by removal of infection.

This paper has been written from the point of view of the prosthetist. I might say that this view is a narrow though an important one. The principles involved go much farther. They apply to all branches of dentistry and to much of medicine. Preventive dentistry is feasible and will inaugurate a new era in dental practice.

Only the findings have been given in the foregoing report. The background may be mentioned. I started taking blood for analysis five years ago, having in mind its application to prosthesis. For some time, these tests meant little to me. Eventually, as they came to have some significance, more and more were made, until my own practice became too small a field for investigation. I had been a member of the Mercy Hospital staff for several years and so succeeded in making arrangements to continue my investigation there. I have had the utmost in cooperation. All patients, records and tests are available to me. Any test is made which may be desired and any recommendation followed.

The nurses at the institution are under my direction. The Kahn test, calcium-phosphorus tests and metabolism tests are given each nurse. Their teeth have regular inspection and complete records are kept. It is my intention to take the incoming class of nurses through their three-year course without additional caries. The efforts along this line have been sponsored by the University of Michigan, full credit being given in the school of postgraduate research. Such an opportunity for clinical investigation, I believe to be unequaled.

MERCURIAL STOMATITIS*

By J. R. McGEORGE, D.D.S., Logansport, Ind.

MERCURIAL stomatitis is a pathologic condition of the mouth that has received little attention in the literature. Many writers have confined themselves to a single paragraph and others have been inaccurate in their description. While the condition is not a rarity, it probably is seldom seen by the general practitioner. According to the older textbooks, it was quite prevalent owing to the excessive administration of calomel, and patients were intentionally salivated, thinking therapeutic results could not be obtained until the medicament "touched" the gums.[1] The general laxity in hygiene of the mouth at the time was no doubt also a factor in the severity of the attacks.

ETIOLOGY

A stomatitis resulting from the toxic action of mercury may be induced in several ways. Industrially, it may be inhaled in the form of mercury vapor, although industry has now taken steps to prevent this hazard to employes. The more common occurrence is from its use as a medicine in some form, and this is especially true in the treatment of syphilis. The stomatitis does not necessarily indicate overdosage, but may signify an idiosyncrasy. Some individuals are able to tolerate large quantities of mercury, while others are very susceptible to its poisonous effects. The syphilologist, in his use of the drug, is bound to induce stomatitis in certain cases. In persons particularly

*Read before the Cass County Medical Society, Logansport, Ind., May 18, 1934.

1. Shoemaker, J. V.: Textbook of Materia Medica, Vol. 2, Philadelphia: F. A. Davis Co., 1893; p. 665.

sensitive, severe symptoms of mercurial poisoning may result from 3 grains of mild mercurous chloride given in a single dose[2] or from one one-hundred-sixtieth grain taken daily over a period of time.[3]

PATHOLOGY

There seems to be a difference of opinion as to the pathology of stomatitis. Sollmann[4] says that the action is direct chemical corrosion. Lydstron[5] thinks the peculiar relationship of the inferior dental arteries with the external carotids facilitates mercury accumulation in the cancellated tissues of the mandible; this accounting for its being affected first. Minute globules plug the arterioles and venules, congestion resulting. Bessesen[6] believes that mercury probably forms a compound with the blood which unites with the hydrogen sulphide produced by bacteria in the mouth. The resulting mercuric sulphide precipitate is deposited in the capillary endothelial cells, further reducing the vitality of the tissues already injured, independently of the vasodilation. Bacteria then act on the abraded surfaces of the mouth, ulcers forming at those points. Burchard and Inglis,[7] in defense of the same theory, cite the work of Hartzell and Henrici[8] on cats that were fed calomel until a stomatitis developed. They then isolated streptococci from the mouth and cervical lymph glands, showing the action of oral streptococci on tissues with reduced resistance.

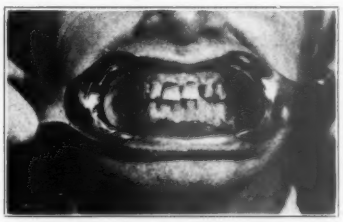


Fig. 1.—Swollen gingivae crested with white membrane.

SYMPTOMS

The first symptoms noted are a swelling and inflammation of the gingival tissues, usually crested with a white membrane. (Fig. 1.) The tissues are very red and prone to bleed. This condition may be localized around a few of the teeth, or it may be uniformly distributed around all of them. The lower molar and lower incisor regions are most frequently first affected. The pericemental membrane of those teeth involved is inflamed and the teeth are tender to the touch. The tongue is swollen slightly and has a white coating. The patient

Fig. 2.—Prints of teeth on tongue and ulcer on upper lip.

2. Crutiscu, J.: J.A.M.A., 91:1909 (Dec. 15) 1928.

3. Editor's note, J.A.M.A., 92:412 (Feb. 2) 1928.

4. Sollmann, Torald: Textbook of Pharmacology, Philadelphia: W. B. Saunders Co., 1901; p. 633.

5. Lydstron, G. F.; Genito-Urinary, Venereal and Sexual Diseases, Philadelphia: F. A. Davis Co., 1899; p. 472.

6. Bessesen, in bibliography of Stokes, J. H.: Modern Clinical Syphilology, Philadelphia: W. B. Saunders Co., 1928; p. 305.

7. Burchard, H. H., and Inglis, O. E.: Dental Pathology and Therapeutics, Philadelphia: Lea & Febiger, 1926, pp. 40-610.

8. Hartzell, T. B., and Henrici, A. T.: J.N.D.A., 4:496 (May) 1917.

complains that the mouth feels hot and that he has a metallic taste in the mouth. There may be no apparent increase in the flow of saliva at this time, but it will be thick and ropy. The so-called characteristic blue line is not present. It is possible that ingestion of some forms of mercury may induce it, but we have never seen it as a result of the intramuscular use of mercuric salicylate.

If this primary stage goes unobserved, the symptoms steadily increase in severity. The tongue becomes greatly enlarged and, owing to this swelling, the teeth leave prints along its sides and tip. (Fig. 2.) These indentations are parallel with the long axis of the teeth and are lined with a gray slough. The mucous membrane of the cheeks and lips is similarly affected with a grayish white, gangrenous membrane which continues as far as the mucosa is in contact with the teeth. In other words, there is an association between the teeth and those tissues that ulcerate. The lips are swollen, and the vermilion border is dry and cracked. There is a steady drooling of saliva. (Fig. 3.) The teeth are covered with sordes and are very loose. There should be no extraction at this time unless the teeth are so loose that there is danger of their falling out. Ulcers may be situated at any point in the mouth, but the labial fold of the lips (Fig. 2) and the under surface of the tongue (Fig. 4) are the usual areas involved. The odor from such a mouth is very marked, permeating an entire room or ward. The patient soon becomes emaciated and speech and deglutition are almost impossible. The mandibular lymph nodes may or may not be swollen, their condition being of no diagnostic value. There is a diffuse redness of the soft palate and tonsillar region. In this area, there may be ulcerations covered with a white necrotic membrane. According to Zinsser,[9] if there is only one spot and the other manifestations are slight, the condition cannot be distinguished from diphtheria.

Fig. 3.—Drooling of saliva.

Fig. 4.—Lesion on under surface of tongue.

DIAGNOSIS

The clinical picture is somewhat similar to that of Vincent's stomatitis. There is not the peculiar breath usually associated with that infection. Instead, there is a fetid odor that is very distinct. If there is any doubt as to a differential diagnosis, the microscope will rule out Vincent's conclusively. A sore mouth with a history of systemic treatment of any kind should immediately suggest the possibility of mercurial stomatitis. Several cases have been reported in which, while antisyphilitic treatment with bismuth and arsenicals was being given, a

9. Zinsser, F.: Diseases of Mouth, transcribed and edited by John B. Stein, New York: Rebman Co., 1912; pp. 46-173.

Vincent's infection was contracted,[10] but not one has been recorded in which the patient was receiving mercury.

PROGNOSIS

Mercurial stomatitis in an ill-kept mouth is not necessarily an index of overmercurializing. A greater toleration of treatment is observed if mouth conditions are favorable; and if reaction does occur, it will be less severe, with a fair prognosis. The opposite is true in the case of poor oral hygiene. The ravages of gangrene and necrosis are tremendous and, in all probabilities, a number, if not all, of the teeth will be lost.

PROPHYLAXIS

Prevention is a dental problem, and there is little occasion for a severe reaction developing. Incidentally, the condition never occurs in an edentulous mouth. Before antisyphilitic treatment is started, the patient should be sent to the dentist for a thorough oral prophylaxis. All calculus, broken down teeth and roots, sharp edges on teeth or fillings and anything else that might be irritating must be removed. The patient should be urged to cooperate in keeping the mouth as clean as possible and to return periodically for examination. If this precaution is taken, any slight change in the mouth will be promptly observed and reported to the physician that he may modify or discontinue treatment, as he sees fit. This procedure is followed here with excellent results.

Seemingly, the mouth is the first part of the body to be affected owing to the selective action of the drug. A flare up of this kind is undoubtedly a warning signal, and, if it goes unobserved, destructive changes in other parts of the body may be expected.

TREATMENT

The treatment is principally palliative. The administration of mercury must, of course, be discontinued. Mercury is cumulative in its action and no improvement can be expected until the body has eliminated that amount which was over and above the point of tolerance. In fact, for a few days or a week after the last injection, the stomatitis may become more acute in spite of any local treatment instituted. Potassium permanganate 1:1,000 is useful as a mouth wash or spray to counteract the foul odor. A dram of iodoform in 2 ounces of glycerine, applied topically, as advocated by Prinz,[11] seems to alleviate the pain somewhat in a severe case. An agent releasing nascent oxygen, such as hydrogen peroxide or sodium perborate, is indicated. Thin strips of cotton or gauze about 5 or 6 inches in length and soaked in boric acid are inserted between the cheeks and gums and should cover the buccal and labial surfaces of the teeth. These packs are applied both above and below to prevent the mucous membrane from coming in contact with the teeth. The same procedure is indicated on the lower lingual surfaces, but the packs are difficult to hold in place. The dressings should be changed several times a day and those applied buccally may be allowed to remain overnight. The cheeks will prevent them from becoming dislodged. It has been suggested that atropine be given to control the flow of saliva.[7] This hardly seems advisable since the saliva is one source of elimination for the metal and elimination is of prime importance. Potassium chlorate, at one time, was con-

10. Donson, S. D.: Vincent's Infection Contracted During Luetic Treatment, D. Cosmos, 75:883 (Sept.) 1933.

11. Prinz, Herman: Dental Formulary, Philadelphia: Lea & Febiger, 1923; p. 223.

sidered a specific for ptyalism. The theory was that it would be excreted through the salivary glands and keep the mouth bathed in a solution that was saline, stimulating and mildly astringent. Such a medicament would be ideal, but, according to the U. S. Dispensatory,[12] there is little foundation for the belief, as potassium chlorate is eliminated principally through the kidneys. There is probably very little, if any, action in the mouth.

Stokes[13] advises that sodium thiosulphate be tried in a series of three doses, 0.5 to 1 gm., given intravenously every second day. As this form of treatment has never been tried here, I have no comment to offer as to its value. We have used a 10 per cent solution of sodium thiosulphate as a mouth wash, with doubtful results.

The diet, of necessity, will be mainly liquid. Carbohydrates and acid-free foods are indicated, but condiments, especially salt and spices, should be omitted. The system should be alkalinized and bowels kept moving freely.

SUMMARY

1. Mercurial stomatitis may be induced industrially and therapeutically. It usually results from the use of medicine containing some form of mercury.

2. Some persons are very susceptible to the toxic action of mercury.

3. The pathologic process has not been definitely determined. It may be direct corrosion by mercury in the saliva or possibly a superinduced infection in a field of reduced resistance.

4. Stomatitis becomes very severe if allowed to progress. Sloughing and ulceration occur on the tongue, lips, gums and cheeks. Teeth loosen and are covered with sordes. The tongue is swollen and there is continual drooling of saliva.

5. Extraction is contraindicated during the acute stage.

6. The clinical picture resembles Vincent's. History taking and the use of a microscope will differentiate. The odor is characteristic. The blue line is not.

7. Poor mouth hygiene is a predisposing factor in mercurial stomatitis, which never occurs in an edentulous mouth.

8. Prevention is a dental problem. Before mercury treatments are started, the patient should be sent to a dentist for examination and prophylactic care. A periodical examination should be made during the course of treatment.

9. The mouth is the first part of the body to be affected; therefore, the stomatitis must be promptly observed to prevent destructive changes elsewhere.

10. Local treatment should be palliative. The administration of mercury should be discontinued, the system alkalinized and diet regulated.

Logansport State Hospital.

12. U. S. Dispensatory, Ed. 21, Philadelphia: J. P. Lippincott Co., 1926; p. 883.

13. Stokes, J. H.: Modern Clinical Syphilology, Philadelphia: W. B. Saunders Co., 1928; p. 308.

LEUKOPLAKIA

By HOMER C. VAUGHAN, D.D.S., New York City

APPROXIMATELY two years ago, in the Prosthetic Infirmary at New York University College of Dentistry, a number of cases of leukoplakia involving chiefly the hard palate were seen, in edentulous mouths for which vulcanite dentures were to be made. Several interesting facts were observed during the handling of these cases.

First, leukoplakia disappeared completely in a relatively short time under vulcanite bases. If the patches were present over both the hard and the soft palate, a distinct line of demarcation appeared at the border of the denture (the patches continuing on the soft palate disappearing under the vulcanite base). These changes took place without any alteration of the patient's habits or environment other than the insertion of a vulcanite denture.

A chart was drawn covering the following information: the patient's name and chart number; a detailed description of the leukoplakia existing before the dentures were made; the condition one week after insertion, the condition two weeks after insertion, etc. A series of new cases were then charted. As a result, more detailed observations were made of the leukoplakia patches, i.e., their relative number and position, with careful description of all observable conditions. As a result, a second unusual character was noted: that there seemed to be, from a purely clinical aspect, two very distinct manifestations, varying greatly in appearance and reaction to vulcanite bases.

One manifestation presented large, isolated, snowy white patches indicative of a considerable degree of hyperkeratinization. Between these patches were areas of considerable redness, with a raw ready-to-bleed appearance. This erythema existed to the greatest degree at the base of the patch, gradually fading toward the periphery. From a purely physical aspect, these cases appeared to involve areas subjected to considerable irritation. They existed chiefly on the posterior half of the hard palate and on the soft palate. The appearance of these patches clinically suggested an acute condition. This type of patch disappeared quickly under vulcanite dentures, usually within one week. They seemed to melt away.

In the other manifestation, there were a large number of small grayish white patches, which coalesced to form a diffuse sheet. This type exhibited little or no erythema, had a general aspect of a chronic condition, and took a longer time to disappear under vulcanite bases; as a rule, about two months.

The following two cases illustrate one of each variety charted, and are typical of the results obtained:

F. V., a man, presented large isolated white patches scattered over the hard and soft palate and raised about 1.5 mm. They were very much cornified and white and rested on a very red and irritated base. The condition one week after the denture was inserted was very much improved. Two weeks after insertion, the patches are almost completely gone. One

month after insertion, there was no evidence of leukoplakia on the hard palate.

J. M., a man, had a generalized leukoplakia over the entire hard palate before insertion of the dentures. The lesions were grayish white and rough to the touch. This condition improved two weeks after insertion and the patches were almost entirely gone after two months.

CONCLUSIONS

1. There are probably two distinct clinical manifestations of leukoplakia.

2. Vulcanite dentures are a means of treatment of patches occurring over the hard palate and lower ridge, rather than a source of irritation as has been commonly believed. (It is well to note that in mouths with a full complement of teeth, a vulcanite palate will be of aid.)

3. It is assumed that the insulating and protective covering afforded by vulcanite are the chief factors in the improvement noted.

These observations are being continued in greater detail.

THERAPEUTIC TREATMENT OF ROOT CANALS*

By RAYMOND L. GIRARDOT, D.D.S., Detroit, Mich.

A NUMBER of years ago, an incident at a gathering of dentists impressed certain of us very much. A hypothetical case of dental disease involving the pulp was cited, and the question asked of each man as to what remedy he would use in that case. Thirty-three men were present and twenty-three different agents were recommended.

Obviously, many of the recommendations were made with little thought and study of the actual physiologic and chemical action of the agent.

This occurrence, purposely precipitated, resulted in a radical change in the methods of treatment by the members of this group.

In this connection, a report of James E. Aiguier[1] is very interesting. He states that in 300 returns from a questionnaire, forty-five different remedies were suggested in the treatment of root canals.

Occasionally, articles are still published in our journals advocating methods of treatment supported merely by the empiric experience of the writer, notwithstanding the voluminous research work by many able men whose data cannot be reconciled with the technic of these writers.

Unfortunately, many readers accept the statements made without question, merely because they are published in a dental magazine.

My purpose in this presentation is to discuss the agents which are generally

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 10, 1933.

1. Aiguier, J. E.: Dental Medicaments; Their Care, Use and Application in Everyday Practice, D. Cosmos, 70:329-339 (March) 1928.

used as acceptable remedies under certain conditions; also, those about which there is still controversy, and, in addition, those frequently employed which, in the opinion of many, are positively contra-indicated.

I shall endeavor to outline procedures that are not original, but are gathered from the experience of men who have striven to analyze the effect of certain agents on living tissue in and around the roots of teeth.

Let us first fix firmly in mind the premise that we cannot judge the final success of a therapeutic agent by the factor of pain or comfort to the patient, any more than we can determine whether infection exists from the appearance in the roentgenogram of regenerated tissue.

Microscopic studies of cases the history of which is known, several years after treatment, gives us much desirable information. Let us first consider vital pulp removal.

VITAL PULP REMOVAL

Rarely are we called on to remove a healthy pulp, and even if we consider it healthy, we are not certain that bacteria are not present within it. Consequently, we will accept the statement of Edgar D. Coolidge[2]: "All cases requiring root-canal treatment should be considered as infected cases, for it is seldom that a pulp is removed which is not badly infected." Our first step, therefore, is to seal in the cavity an anodyne treatment of oil of cloves containing chloretone. We desire to eliminate any existing pulpitis as well as to sterilize the dentin and reduce infection within the pulp. This surface sterilization is very important, particularly for those who persist in using pressure anesthesia. The dressing should be sealed in the cavity with temporary cement, as temporary "stopping" is contra-indicated. A temporary cement should be selected that will set over an oily dressing. Certain cements will not do so.

Next, the method of pulp removal is determined. Pressure anesthesia is used by many operators; but, since the investigations of Blayney,[3] I prefer to accept his conclusion that pressure anesthesia with cocaine hydrochloride, especially when the cocaine is in 5 per cent solution or over, may be responsible for retrogressive changes following pulp removal, as cocaine, in such solution, is a protoplasmic poison. He adds that block or infiltration anesthesia is to be preferred.

The recent realization of the necessity for careful sterilization of the cavity before pulp removal may bring about a modification of the conclusions resulting from this investigation. Until that time, another method is to be preferred.

Arsenic still has many advocates. I prefer to consider it a protoplasmic poison with no evidence so far presented that it does not travel beyond the end of the root. Inglis[4] states that it does not, supporting his contention with the experiment of Miller (previous to 1894), who placed rings at the roots of the tails of mice. This evidence is not acceptable, and I offer for consideration a recent statement by Blayney[5] that, for years, it was taught that dental pulps died after the application of arsenic, because of strangulation at the apical foramen and that this is not substantiated by the study of slides which show the action of this chemical on the pulp.

2. Coolidge, E. D.: Discussion of Clinical Results of Root-Canal Treatment and Filling, D. Cosmos, 69:1282 (Dec.) 1927.

3. Blayney, J. R.: Medicinal Treatment and Filling of Root-Canals, J.A.D.A., 15:241 (Feb.) 1928.

4. Burchard, H. H., and Inglis, O. E.: Textbook of Dental Pathology and Therapeutics, Ed. 7, Lea and Febiger, 1926, p. 460.

5. Blayney, J. R.: Modern Dentistry, January, 1933, p. 29.

In the interest of those who will not subscribe to the foregoing, let us consider a few factors in the use of arsenic. It would be well to go back nineteen years and review an outstanding contribution to the use of arsenic by George T. Fette.[6] By exhaustive experiment and formulas, he shows why arsenic pentoxide is safer, and produces no pain even when applied to hyperemic pulps. He advocates the use of glycerine to make the necessary paste for its use.

I fail to understand why the trioxide remained in use when the higher valency results in a painless application. The above-mentioned investigation seems to be more recently confirmed in an article by Bossard,[7] of Paris, who states that metallic arsenic mixed with ore known as *Scherbenkobalt,* and erroneously described in English as "cobalt" is much less harmful than arsenic trioxide. Bossard is an advocate of the use of arsenic by the small measured dose of 0.00079 grain, which can be secured in the tablet form under the name nervarsen. He condemns the reckless unmeasured application of the trioxide and says: "The arsenic does not only penetrate from the pulp into the dentin of the tooth, but diffuses itself also into the surrounding bone tissue, and the younger the tooth the quicker is this diffusion. Heinze demonstrated that after the fourth day arsenic can be found chemically present in the pericementum."

Now if arsenic is to be used, I would prefer to submit to a measured dose of the pentoxide, wrapped in a small bundle of bibulous paper, so that, on removal, it may be entirely recovered and not mechanically scattered throughout the cavity.

Our third method and the one considered the most acceptable is block anesthesia. One drawback to this method is the fact that, notwithstanding how nearly perfect the anesthesia may appear to be from the exodontist's standpoint, pain is still experienced in the actual removal of the pulp. This is particularly true of the lower molars. L. O. Brightfield[8] makes an excellent contribution to the solution of this difficulty, wherein he finds that infiltration anesthesia should be used in combination with conduction. The palatal and buccal regions should both be anesthetized for the upper teeth, and the long buccal injection given for lower molars.

After the removal of the pulp, which is done with sterile instruments in a sterile field, and the technic of which is not within the scope of this paper, frequently a slight hemorrhage occurs within the canal. This may be easily controlled with an aqueous chlorine solution, which is used to wash out the canal and also as a treatment until the next appointment, when the mechanical enlargement is begun. Care should be taken to keep blood out of the crown of the tooth as this is one cause of discoloration. A popular error is the use of hydrogen peroxide at this time. With blood in the crown of the tooth, this combination usually results in discoloration.

Some may experience great satisfaction on viewing the pulp dangling on the end of a broach, and feel that the operation is completed. I refer them to a statement by Skillen[9] that the pulp has not been removed in its entirety, for, in all likelihood, considerable tissue has been left adhering to the walls of the canal. He

6. Fette, G. T.: Higher Valency of Arsenic Versus the Trioxide in Devitalization of Dental Pulp, D. Cosmos, 56:1232 (Nov.) 1914.

7. Bossard, F. J.: Devitalization and Anesthesia, D. Cosmos, 72:148 (Feb.) 1930.

8. Brightfield, L. O.: Eliminating Pain in Root-Canal Work, D. Cosmos, 73:79 (Jan.) 1931.

9. Skillen, W. G.: Morphology of Root-Canals, J.A.D.A., 19:727 (May) 1932.

adds: ". . . only the most thorough and prolonged curettement of the walls of the canal seems to offer hope for satisfactory accomplishment in this direction."

The enlargement should not be made at this time because of the danger of going beyond the end of the root, since the surrounding tissue is anesthetized and also because the pulp canal probably contained an unsterile pulp. When the question of immediate root filling comes up, the foregoing reasons hold against it, as well as the inability of the operator to guarantee that nothing occurred in the chain of an aseptic technic that would leave the pulp canal less sterile than before he entered it.

Some operators place a supposedly sterile dressing alone in the canal; others, a very mild antiseptic, such as boric acid. The latter is dangerous and is the antithesis of placing formocresol in the pulp canal in such a case to be sure it is sterilized. I might suggest that the latter operator seal some formocresol on his arm, under oiled silk, for a few days. As a result, he may give careful consideration to the effect of formaldehyde on vital tissue.

Again, other operators advocate the placement of neither dressing nor medicament in the canal. From another point of view, the work of Coolidge[10] condemns this as bad practice: ". . . after pulp removal, the cavity was sealed, an empty canal being left beneath a filling . . . exudate and dead cells accumulated within the canal . . . which became a continuous source of irritation to the periapical tissues. . . ."

In the same report, Coolidge, in his experiments on dogs, made the observation that, in root canals, drugs that have the property of coagulating albumin appeared to be self-limiting in their action and did not penetrate deeply. He states further that eugenol and eucalyptol produced periapical irritation, while oil of cloves caused the least reaction. Cresatin and hexylresorcinol solution, which did not coagulate albumin, penetrated deeply and produced irritation; and that drugs that are germicidal but not self-limiting by the coagulation of protein should not be looked on as harmless to living connective tissue.

Our ambition to prevent infection without irritation, is further confirmed by additional work of Coolidge,[11] who states that the possibility of repair is dependent on the absence of infection, and demonstrates that a deposition of cementum can take place in accessory canals at the apex of a tooth after pulp removal. Keeping the foregoing report in mind, let us consider several recommendations for suitable treatment after pulp removal. Carl J. Grove[12] expresses preference for a 10 per cent solution of cresol in glycerine. He states that it is miscible with water in all proportions because of the glycerine content, and will therefore mix with the serum, which is likely to exude from the periapical tissue into the canal. He adds that the advantage of a remedy possessing such properties is that the exudate becomes a part of the antiseptic solution.

Another recommendation worthy of consideration is the use of iodine. L. O. Brightfield[8] urges the use of a 5 per cent solution in pure alcohol, and an interesting article by Joel Eisenberg and Walter

10. Coolidge, E. D.: Reaction of Dog Tissue to Drugs Used in Root-Canal Treatments, J.A.D.A., 19:747 (May) 1932.

11. Coolidge, E. D.: Reaction of Cementum in the Presence of Injury and Infection, J.A.D.A., 18:514 (March) 1931.

12. Grove, C. J.: Simple Accurate Procedure for Treating and Filling Root Canals, J.A.D.A., 17:1634 (Sept.) 1930.

S. Frost[13] recommends a form of soluble iodine. They point out, with many references, that the presence of potassium iodide or other metallic salts in the iodine is highly undesirable, and that free iodine in the form suggested closely approaches the ideal root-canal medicament.

The next remedy generally accepted as having great value is camphorated monochlorphenol. This seems to be considered by the majority of workers as the most efficient agent that we have. It gives a slow liberation of chlorine, while the camphor modifies the caustic action of the phenol. Prinz,[14] in referring to infected root-canals, states that it has proved to be superior for the purpose mentioned over any other drug or drug compound so far tested.

Appleton,[15] Werther[16] and Grossman and Prinz[17] all used camphor-monochlorphenol in their studies on the comparative efficiency of a therapeutic agent and electrolytic medication.

To those who use Callahan's rosin-chloroform method of filling the root, I might point out the fact that the above-described remedy is of an oily nature, and no oily dressings should be placed in a root previous to the use of this method, as it would interfere with the transmutation of the alcohol and the chloroform in the tubuli of the dentin.

Reminding ourselves that we are still discussing treatment after removal of a vital pulp, let us consider chlorine. Perhaps a description of its action by Blayney[18] might be apropos. He states that it attacks the protein molecule of the bacteria by replacing its hydrogen atom or atoms; the major portion of the chlorine liberated acts on water because of its affinity for hydrogen and the water molecule is destroyed, liberating free oxygen, which, in turn oxidizes the products of bacteria and bacterial decomposition.

I should like here to express a personal preference for the water-soluble chloramine T. About 1 ounce at a time should be poured from the stock bottle into an amber glass-stoppered dropper-dispensing bottle. When it is used, small quantities should be placed in a dappen dish, and later the unused portion should be thrown away. Care should be exercised not to smear the top of the dispensing bottle, and, after use, always to wipe off the lip of the stock bottle. Coolidge[19] gives the following formula for an aqueous solution:

Chloramine T. (U. S. P.)	5 gm.
Sodium chloride	0.8 gm.
Sodium hydroxide	0.5 gm.
Distilled water q. s. ad	100 c.c.

I do not approve of the use of dichloramine T dissolved in oil. It is difficult for the average person to make up and decomposes very readily, hypochlorous acid, which is very irritating, resulting.

Steel pliers, or remnants of amalgam left in the cavity, should never come in

13. Eisenberg, Joel and Frost, W. S.: Value of Iodin in Control and Treatment of Dental Infections in Root-Canals and Periapical Areas, D. Items Int., 54:833 (Nov.) 1932.

14. Prinz, Hermann: Dental Materia Medica and Therapeutics, St. Louis: C. V. Mosby Company, Ed. 6, 1928, p. 171.

15. Appleton, L. L. T., Jr.: Attempt to Formulate Policy on Management of Pulpless Tooth, D. Cosmos, 75:136 (Feb.) 1933.

16. Werther, Raymond: Use of Electrolytic Therapy in Treatment of Periapical Infection, D. Cosmos, 74:329 (April) 1932.

17. Grossman, L. I., and Prinz, Hermann: Comparative Study of Root-Canal Therapy and Camphorated Chlorphenol and with Electro-Sterilization, D. Cosmos, 74:327 (April) 1932.

18. Blayney, J. R.: Medicinal Treatment and Filling of Root Canals, J.A.D.A., 15:239-243 (Feb.) 1928.

19. Coolidge, E. D.: Pathology, Diagnosis and Treatment of Pulp and Preparation of Root-Canals for Filling, J.A.D.A., 19:1981 (Nov.) 1932.

contact with a chlorine solution, as the solution will become inert and valueless as a germicide. Stellite or a good quality of stainless steel pliers may be used.

If the pulp chamber is flooded with an absorbent point in place, and the latter is suddenly jerked out, the vacuum produced will draw the medicament into the root canal.

It should be remembered that a treatment of the aqueous chlorine solution is good for only twenty-four hours, and if the patient cannot return in that time, another agent must be used.

When the patient returns, a troublesome condition is often found in that there are vital remnants in the pulp canal. When the operator is certain from roentgenographic measurement that he cannot reach the apex on this account, he may dip a fine reamer in phenol and work it along the pulp fragment. If this will not suffice, a dressing moistened with phenol may be sealed in the canal.

To sum up the agents considered acceptable after removal of a vital pulp, they are: aqueous chlorine solution, camphor-monochlorphenol, iodine (as described), 10 per cent cresol in glycerine and oil of cloves.

PUTRESCENT PULPS

The pulp chamber should be well opened if the tooth is not too sore. It must at least be opened sufficiently to permit drainage and relief from gas pressure. The pulp chamber is washed thoroughly with aqueous chlorine solution, and if organic material can be teased out of the openings of the canals, this may be done, provided no pressure is brought on it.

This is the one and only time that formocresol is indicated, and Buckley[20] has given an excellent explanation of its effect. A paper pellet slightly moistened with this agent should be sealed in place with temporary cement. On the patient's return with a report of relief from pain, the pulp chamber should again be washed with the chlorine solution. The canals should then be flooded and a fine broach used to tease out the particles.

We can now consider an interesting recommendation by Grove[12] regarding the use of chlorothymol, which consists of equal parts of chloral hydrate and thymol, with sufficient acetone to keep them in solution. The thymol is used for its germicidal power; the acetone dissolves fats, making penetration of the thymol more effective. Grove asserts that the chloral hydrate unites chemically with the gases of putrefaction.

After the canals are cleansed of organic materials, the following agents may be considered acceptable to sterilize the dentin and apical tissues: aqueous chlorine solution, camphor-monochlorphenol, chlorthymol or iodine (as described). Our choice of procedure would be electrolytic medication. Appleton,[15] Werther[16] and Grossman and Prinz[17] have all shown that it required half the number of treatments as were required with camphorated monochlorphenol. Electrolytic medication has not been employed as it should be because the time consumed in its application has been costly. Perhaps the knowledge that it is twice as efficient may affect this drawback, and bring it into greater favor in root-canal therapy.

Another objection was the cost of the equipment, but a little ingenuity with a 45-volt B battery, potentiometer and milliameter, and the use of an unbalanced circuit with a fixed resistance, would produce an outfit having a more delicate control than the expensive equipment offered for sale. The investigators just

20. Buckley, J. P.: Dental Materia Medica and Therapeutics, Philadelphia: P. Blakiston's Son & Co., Ed. 5, p. 74.

mentioned also demonstrated that it required five or six treatments of camphormonochlorphenol to secure a sterile dressing from teeth that were so badly infected that we would ordinarily extract them.

In the technic for the enlargement of the canal, some operators have advocated the use of sulphuric hydrochloric and even nitrohydrochloric acids. In difficult canals, I can see the logic of using hydrochloric acid to assist in its enlargement. When the apex is accessible, the use of acid is not to be condoned. I decline to accept the assumption that hydrochloric acid is a good tonic for the apical tissues. In this respect, I should like to refer to Blayney's[21] statement that in the therapeutic treatment of such cases, the pathologic processes involved must be kept constantly in mind and, during treatment, this inflamed area must not suffer additional injury by mechanical or chemical trauma.

21. Blayney, J. R.: Apical Tissue Reaction to Treatment, J. D. Res., 9:239 (April) 1929.

In the removal of old root fillings, sterilizing treatments should be used over the filling before removal. I believe the chlorine agents to be the best for this purpose. After a root is filled and a portion of the filling removed for a dowel post, an oily agent should not be used to keep it sterile, as the root filling will be softened. Metaphen is excellent for this purpose.

I should like to conclude with a few words of caution: Never use cotton in a root-canal. Sterilize the paper points after removal from the packages in which they are purchased. Clip the ends from the paper points if they are likely to protrude through the apex. Do not force the medicament through the apex and thus use too much. Do not let cases drag along or overtreat them. Seal every medicament in. Consider germicidal root fillings that are diffusible as medicaments and not as permanent root fillings.

562 Fisher Building.

COOPERATION OF PHYSICIAN AND DENTIST IN PREVENTION AND EARLY RECOGNITION OF DISEASE*

By R. GORDON McLEAN, D.D.S., F.A.C.D., Toronto, Canada

CHARLES H. MAYO recently made the following statement: "Talking of the interdependence of medicine and dentistry is like talking of the interdependence of medicine and surgery or medicine and obstetrics. The practice of medicine includes dentistry, and dentistry is a special branch of medicine."

Whether dentistry should be a separate profession may be a point of contention, but there can be no argument against a closer cooperation between the two professions in examinations for discovery of disease of the oral cavity.

What is necessary to secure efficient cooperation? First, that the dentist have a reasonable medical background—considerably more than even the present dental student obtains, in spite of the

*Read before the American Association for the Advancement of Oral Diagnosis, St. Paul, Aug. 6, 1934.

marked advance dental education has made along these lines in recent years. Secondly, that the physician know sufficient dentistry to understand dental points of view and values—considerably more than students receive in the medical education of today. Thirdly, that ethics never be forgotten and good fellowship always prevail. When these conditions are fulfilled, the patient should be fairly sure of sane and logical decisions from the consultation of competent, experienced practitioners.

The dentist must develop a broader view of his duties to his patient than that encompassing only repair of the ravages of dental caries, and the extraction of teeth or their restoration. He must view the oral cavity as an integral part of a very complex body, always keeping in mind that complete functional activity depends on complete systemic integrity. He must recognize the fact that any departure from the normal in the mouth may be the cause, the effect or the symptom of systemic or organic disease in other parts of the body. The health of the patient must always be his first consideration. He must study and know normal tissue and develop his powers of observation to the point where, in an examination, he sees what he looks at. His examination should be methodical, thorough and painstaking, with all results recorded on a suitable chart.

Both clinical and roentgenographic examinations, and we wish to emphasize that neither is complete without the other, are necessary if we wish to arrive at even a fairly reliable diagnosis. We believe that a very serious mistake is made by a few practitioners, who depend entirely on roentgenographic examination in the search for dental foci of infection. It is only the odd case that a careful clinical examination does not add to, as well as checking up and corroborating the findings of the film examination.

The most frequent causes of faulty diagnosis from the dental standpoint are: (1) failure to take into consideration the past and present history of the patient; (2) lack of sharp, distinct detail of the teeth and periodontal tissues in dental films; (3) insufficiency in number of films to show clearly all roots of multi-rooted teeth; (4) failure to make a careful clinical examination, and (5) taking for granted that all periapical structural change signifies infection and that the mere presence of incidental bacteria is proof of infection.

The dentist who recognizes his responsibility for the health of his patient may, at times, find oral conditions that point to the possibility of systemic disease which should receive medical care. It is not his part to make the diagnosis in such cases, but he can at least suggest a medical examination and so aid in early recognition of the condition present. For instance, he may note pallor of the skin and mucous membrane, suggesting anemia; the edema of the eyelids of a nephritic; a simple enlargement of a thyroid; evidence of adenoids or diseased tonsils; the bulging of the eyes and extreme nervousness of exophthalmic goiter; the well-known oral indications of syphilis; the breath of a diabetic, and the presence of leukoplakia, mucous patches or neoplasms. What a wonderful opportunity for service the dental profession has now that a semi-annual periodic dental examination has become common practice!

The physician makes a routine examination of the mouth and notes the possible presence of caries, periodontoclasia, malocclusion, lack of hygiene, fistulas, Vincent's infection (or, as Box now describes it, necrotic gingivitis) and such other lesions as may be found in the oral cavity. He will advise dental treatment,

but will naturally refrain from giving final advice without consultation with the patient's dentist. If he does not get cooperation in that quarter, he is perfectly justified in asking for a consultation with another dentist.

The cooperation of the obstetrician and the dentist is of the highest value to the expectant mother. It is very important that special care be given the teeth and periodontal tissues during pregnancy, and the patient, naturally having every confidence in her physician, will be impressed with his advice in regard to the importance of dental attention. Any probable foci of infection found in the mouth of expectant mothers have to be taken into consideration and disposed of according to the wishes of the obstetrician. There is no doubt that the safest time for the extraction of septic teeth is before pregnancy or between pregnancies, provided the patient does not suffer pain and shock, no harm will come from ordinary extractions in normal cases.

In the first few years of the life of the child, it should be the aim of the physician to prevent dental caries and develop normal dental arches. Supervision of the diet of the nursing mother and afterwards that of the young child has produced remarkable results in the prevention of caries of the deciduous teeth. During the early years of childhood, the pediatrician is careful to inquire regarding certain harmful habits the child may acquire, such as thumb sucking, tongue biting, lip interposition and mouth breathing. Very marked distortion of perfect arches always results if such habits are not checked. Of inestimable value is the physician's detection of caries in deciduous teeth in its early stages. He should emphasize and explain to the mother the grave dangers of allowing caries to progress to pulp involvement, with its possible sequence of infection and sensitization of the child to certain bacteria.

Through the neglect of the dentist or that of the patient, or on account of accident, root canal operations are still necessary from time to time from the age of 10 and 12 years upward. In selected cases, it is possible with careful technic to fill the root canals successfully and maintain asepsis. Very often, consultation with the physician should take place before such operations are attempted. The susceptibility of the patient to infection should not be ignored in these cases.

In the adult clinical examination, a systematic routine procedure should always be followed. One might start with the color of the skin, then observe the facial contour, lips, saliva, tongue, floor of the mouth, mucous membrane of the cheeks, teeth, periodontal tissues, hard palate, soft palate, tonsils and glands. Any abnormal conditions outside the field of dental treatment should be reported to the patient and medical attention advised.

Following the clinical examination, the diagnostic roentgen-ray examination is made. Teeth that were regarded with suspicion in the clinical examination may be given special attention and roentgen-ray films taken from different angles. This may require fourteen, sixteen, eighteen or twenty films. Thoroughness and not the film mount should determine the number of exposures made. The findings should be carefully made and recorded.

If it is possible to gain further diagnostic information from laboratory investigation, this should be proceeded with and findings recorded.

When all findings are gathered and recorded, the physician and the dentist are in a position to discuss the case. The physician is able to apply his medical knowledge and experience to interpretation of the family history and the pa-

tient's personal history. He has a full knowledge of the disease from which the patient is suffering and has made a comprehensive physical examination which will include the other fields in which foci of infection can develop. The dentist is able to supply the dental history and give detailed results of his clinical and radiodontic examinations, with his deductions therefrom. Diagnoses arrived at in this manner should be as nearly accurate as present day knowledge permits.

Snapshot decisions based on superficial dental examinations indicate ignorance or lack of professional conscience or both. Moorehead says,

> Teeth are quite important structures and their retention or removal should be predicated upon basic values and facts. We believe that bacteria that multiply and develop and produce cellular change at or about the apices of the roots of pulpless teeth can be transported by lymphatics and blood vessels to the harm of other tissues and organs in other parts of the body, but we must be convinced that the structural change is caused by bacteria and not by traumatic or chemical irritation. Once we have decided that the cause is bacterial we must assume the responsibility of the elimination either by treatment or surgery.

It is not good practice to wait for indications of systemic involvement before eliminating probable foci, for quite often the secondary foci do not disappear on the removal of the primary, and besides prevention is always better than cure.

Prevention is the one and only way that we can lighten the financial burden of disease, and, to that end, our greatest energy should be directed. In the attempt to stem the tide of dental disease by skilful restorations, we must admit that we have failed. Not only have we failed, but, in our struggle to perfect our methods, we have created and devised such skilful, scientific time-consuming technics that the cost of dentistry is becoming prohibitive to the masses. Prevention is the cheapest and yet the best service that we can give the public, and, for that reason, should occupy a more important—yes, the most important place—in dental education and practice. We believe that had we been more closely associated with medicine in the past, our progress in this most important branch of practice would have been much more rapid. Next to prevention, the early recognition of disease is the greatest necessity and of the highest service to the public. Without doubt, the close cooperation of the physician and the dentist in diseases wherein medicine and dentistry meet on common ground must result in a valuable professional contribution to public health.

RESEARCH ON THE REACTION OF TISSUES SUPPORTING FULL DENTURES*

By ELBERT C. PENDLETON, D.D.S., and HENRY GLUPKER, D.D.S., Chicago, Ill.

THIS report deals with the tissue reactions most commonly present in the mouths of edentulous persons wearing artificial dentures. It is the hope that these observations and the studies in the minute anatomy of the jaws may be correlated to broaden our knowledge of the structures in the denture area and contribute to successful treatment in full denture prosthesis.

In selecting material for this study, a few models were chosen that were thought to be representative of the many case records showing the edentulous upper jaw which supports a full maxillary denture opposed by the partially edentulous lower jaw. This choice of material was based upon the assumption that tissue reactions to full dentures are common to both the upper and the lower jaws. The character of the structures in each jaw is similar, although their form and distribution show considerable variation.

The edentulous upper jaw presents a field favorable for study when considered separately, and it was thought that a more dependable analysis of tissue reactions of the upper jaw could be made by considering cases having the maxillary dentures opposed by natural teeth in the lower jaw. It is regrettable and quite remarkable that no records are available of cases presenting the completely edentulous upper jaw opposed by a lower jaw with the complement of natural teeth.

These records were secured at the time when the maxillary dentures had proved unsatisfactory. The models record the condition of the tissues which had developed during the period that the dentures were worn. The models of each case were first studied singly; then, the group was examined for characteristics common to each case, which were: the general form and condition of the bone and soft tissues in the palate; the general form and condition of the bone and soft tissues of the residual alveolar ridge of the upper jaw, and the number, position and condition of the natural teeth in the opposing jaw as related to the different regions of the maxillary denture area.

Functional stress, which is considered as the condition most commonly influencing the reaction of the tissues supporting full dentures, is the only etiologic factor considered in this study. The possible results of the normal change in the form of the residual ridge following the loss of the natural teeth and those resulting from pathologic conditions or injuries are not taken into account. Reactions from these causes are classed among unusual influences and are not considered as pertinent to the problem.

In the interpretation of these clinical studies, the forces of mastication are analyzed according to Wilson's use of the

*Read at the Seventieth Midwinter Clinic of the Chicago Dental Society, Feb. 27, 1934.

*From the Prosthetic and Research departments, Chicago College of Dental Surgery, Dental Department of Loyola University.

terms positive and negative force. A positive force is one that tends to seat the denture more firmly in contact with the supporting tissues; a negative force one that tends to displace the denture.[1] "Positive force" as used herein is synonymous with function. "Negative force" indicates the lack of function.

Figure 1 shows models of the edentulous maxillary denture area and the partially edentulous mandibular dental arch in a man, aged 45. In this case, the reactions of the tissues of the maxillary

Fig. 1.—Maxillary and mandibular models from man, aged 45.

denture area were studied as affected by the forces transmitted by the six anterior teeth of the opposing arch. The right side of the residual ridge of the maxillary model is quite symmetrical from the median line to the molar region. Here, the ridge widens and terminates at the tuberosity, which is covered with hyperplastic tissue. The residual ridge on the opposite side of the arch is irregular. Its vertical height is reduced and the buccolingual width of the ridge is narrow as far posteriorly as the maxillary tuberosity, which shows a covering of pendulous tissue.

The palate appears smooth, with a thin soft tissue covering. The labiobuccal structures are thin and loosely attached except in the regions of the tuberosity.

The natural teeth in the mandibular arch are somewhat unequal in length.

Fig. 2.—Maxillary and mandibular models from woman, aged 39. A full maxillary denture and partial mandibular denture had been worn ten years.

Those on the right are in a vertical position, while those on the left side of the arch are rotated and present a labial inclination. It is assumed that the position of the natural teeth directed mastication toward the right side of the arches. The "positive force" was transmitted to the right side of the maxillary arch.

The maxillary tuberosity of the left

1. Wilson, G. H.: Manual of Dental Prosthesis, Ed. 4, Philadelphia: Lea and Febiger, 1920, p. 318.

side, which is diagonally opposite the area receiving "positive force," shows a pendulous development of hyperplastic tissue.

Figure 2 shows the edentulous maxillary and partially edentulous mandibular models from the case of a woman, aged 39. The residual ridge on the right side of the maxillary model is of normal form. On the left side of the median line, the arch of the anterior portion of the ridge is reduced in size. The cuspid region is prominent and the bicuspid area is about one-third the size of the same area on the opposite side of the arch. The tuberosity

Fig. 3.—Maxillary and mandibular models from man, aged 55.

shows a region considerably enlarged and covered by hyperplastic tissue. The vault of the palate is irregular and has a thin covering of mucosa.

The six natural teeth of the mandibular arch present irregularities in vertical length. The left central incisor is longer by one-half the length of its visible crown than the right bicuspid measured from the mesial surface area. The right cuspid and the left bicuspid are in about the same horizontal plane.

The right side of the mandibular arch presents a more favorable number and arrangement of natural teeth for mastication than does the left side. The abrasion of these teeth bears evidence of their use. Again, it is assumed that "positive forces" in mastication were directed toward the right side of the maxillary arch.

Figure 3 is one of the typical exhibits of the reaction of tissues to full dentures. The edentulous maxillary denture area,

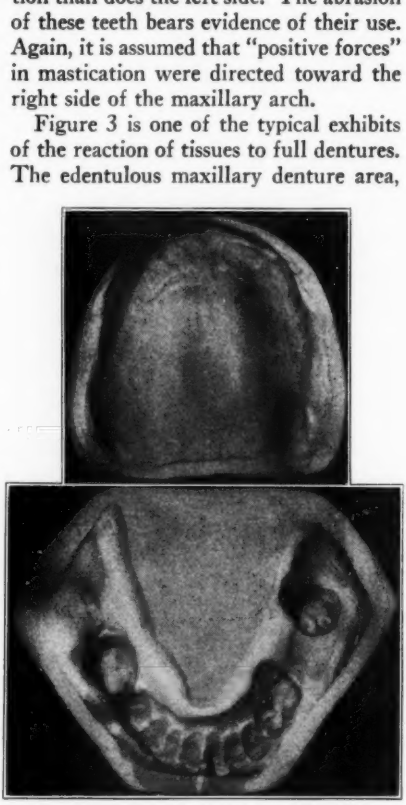


Fig. 4.—Maxillary and mandibular models from woman, aged 60; full maxillary denture worn five years.

and the partially edentulous mandibular arch of a man, aged 55, are shown. The abrasion of the natural teeth on the right side, as well as the absence of the mandibular molar and bicuspid teeth on the left side, identifies the right side of the arches as that habitually used in mastication.

The model of the maxillary denture areas shows the residual ridge on the right side of the median line to be smooth and symmetrical. The left side records structural changes in the bone and its covering of soft tissue. A general reduction in size and change in form of the ridge are noted on the left side of the median line, except in the cuspid and tuberosity regions, where the unused side presents characteristic irregularities in structure. The lingual portion of the ridge appears considerably reduced in size as compared

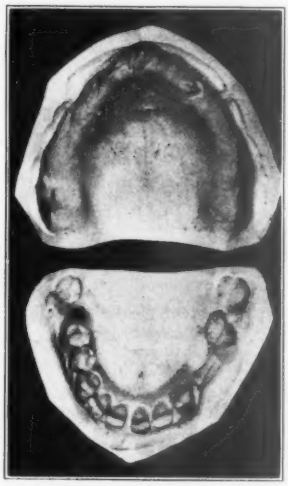


Fig. 5.—Maxillary and mandibular models from woman, aged 52. A full upper denture had been worn six years.

to the opposite side of the arch. Evidence of hyperplastic tissue is seen at the left maxillary tuberosity region. These conditions indicate that the "positive forces" acted on the right side of the maxillary denture area.

The record of Mrs. C., aged 60, is seen in Figure 4. A full maxillary denture was worn five years. This case presents a rather striking picture on account of the location of the remaining teeth and the order in which they appear in the mandibular arch. The first and second molars of the left side are missing. The third molar is elongated and inclined mesially. There are signs of considerable abrasion on the lingual cusps and the distal portion of its occlusal surface. The abrasion of the buccal cusps of the right mandibular first molar and first bicuspid and of the labial surfaces of the lateral and central incisors points to a predominate function on the right side of the arch. The position of the left molar tooth in the arch and the abrasion of its lingual cusps indicate its use as a balancing member in stabilizing the maxillary denture.

The maxillary model shows a well-formed palatine surface. The residual alveolar ridge presents a smooth, even appearance on the right side of the arch. The ridge on the left side presents a characteristic depression in the region diametrically opposite the natural right first molar. The maxillary tuberosity on the left side shows evidence of the development of hyperplastic tissue. The interpretation given after the study of this case is that the "positive force" was directed to the right and "negative force" to the left side of the maxillary denture area.

Figure 5 shows the record of Mrs. B., aged 52, who has been under intermittent observation for six years. The maxillary denture area presents a condition interpreted as chronic inflammation, which is attributed to stresses from the mandibular teeth that are prominent and of unequal vertical length. The tuberosity regions of the alveolar ridge are dense and the anterior portion of the arch of the ridge is covered by a mass of hyperplastic tissue. The structures of the vault of the palate are soft and acutely inflamed. The most abraded surfaces appear on the posterior molar teeth, the left cuspid, the incisors and the mesial

plane of the buccal cusps of the mandibular right first bicuspid.

The tissues of the upper and lower jaws that support full dentures seem to react favorably to functional stresses when the denture base bears a reciprocal relation to these structures. Therefore, the stress of mastication should be distributed according to the natural characteristics and qualities of adaptability presented by the tissues. The dense fibrous tissues are suited by nature to bear the greatest burden during function. The highly vascular tissues must be protected from excessive stresses and the freedom of muscle action must not be impeded by the form of the denture base.

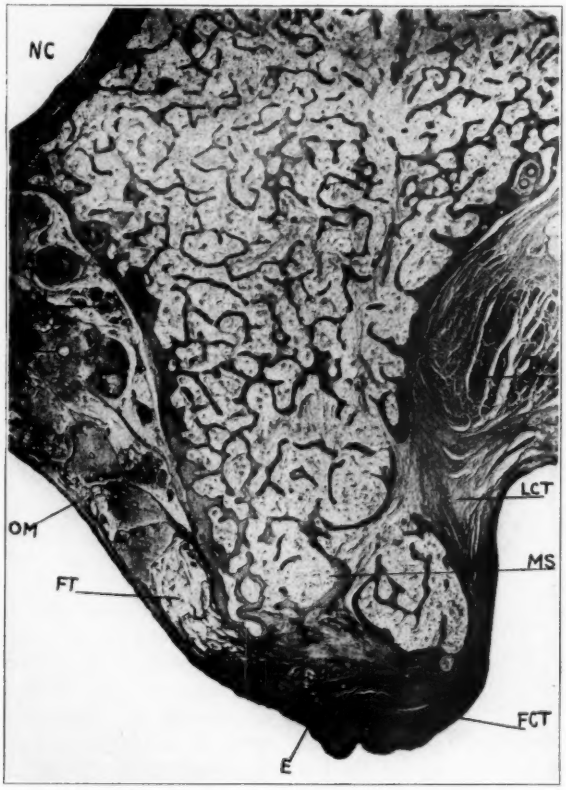


Fig. 6.—Buccolingual section in third molar region of upper jaw from a man, aged 38. *NC*, nasal cavity; *PN*, palatine nerves; *PA*, palatine artery; *SD*, secretory duct from palatine glands; *OM*, oral mucosa; *FT*, fat tissue; *E*, oral epithelium; *FCT*, fibrous connective tissue; *MS*, marrow spaces; *LCT*, loose connective tissue on buccal surface of residual alveolar ridge; *BM*, buccinator muscle.

There can be no doubt that the problem of tissue reaction to full dentures is one that is influenced by functional

stresses.[2] No one factor is of greater significance than that of localized function. Tench calls our attention to "the startling difference between the ease with which younger persons learn to wear artificial dentures and the continuous difficulties of some of their elders.[3] This condition is attributed to the universal tendency among adults toward preference for a certain region of the arch in mastication. This tendency has a demoralizing effect on the stability of the artificial denture and the health of the tissues which form its support.

The work of Leriche and Policard has been found extremely helpful in the interpretation of the clinical manifestations of the tissues supporting full dentures:

> Though the influence of mechanical factors on the general morphology of bone tissue is well established, we know, on the contrary, almost nothing of the exact mechanism of this influence. It is difficult to state the problem, and in short it but gives us an idea of our ignorance.
>
> Mechanical actions, especially pressure and traction, can act on the cells, the fibrils, the pre-osseous substance, calcification and the vasculation of bone. . . . When there is no pressure, bone is formed; when there is strong enough pressure, it disappears. . . . The rôle of strain on the preservation and thickening of the bone framework is incontestable. This generally arises from the load carried by bone, an organ of support; the skeleton is preserved through the exercise of this function. The removal

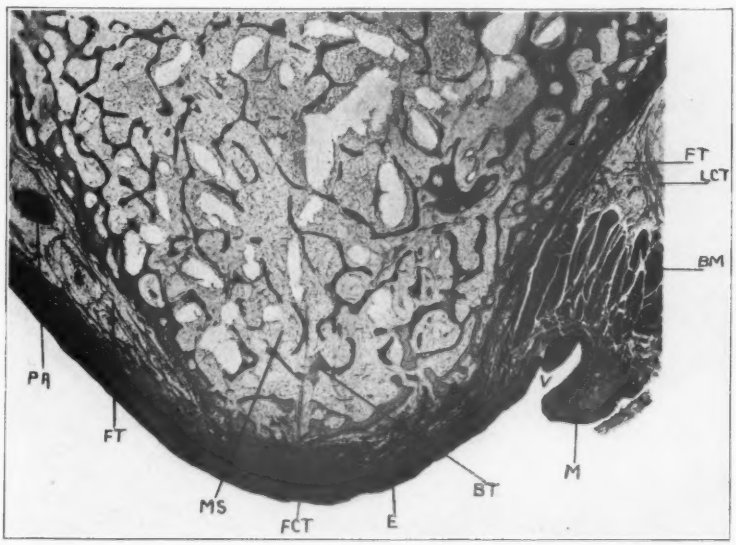


Fig. 7.—Buccolingual section in buccal region of upper jaw of woman, aged 51. *PA*, palatine artery; *FT*, fat tissue; *MS*, marrow spaces; *FCT*, fibrous connective tissue; *E*, epithelium covering residual alveolar ridge; *BT*, bone trabeculae; *V*, vestibulum; *M*, mucosa of cheek; *BM*, buccinator muscle; *LCT*, loose connective tissue.

2. Stansbery, C. J.: Tissue Changes Under Dentures, J.A.D.A., 15:349-353 (Feb.) 1928.

3. Tench, R. W.: Artificial Dentures—Final Stage in Restorative Dentistry, J.A.D.A., 20:1234-1246 (July) 1933.

of all strain through the removal of all load has a fatal influence on bone structure.[4]

The study of tissue reactions to artificial dentures is both interesting and perplexing. It is deemed more pertinent to the success of full dentures to become familiar with the form, character and distribution of the structures normally found in the region of denture support than to pursue the analysis of tissue reactions.

study of the minute anatomic structure of the denture supporting tissues.

The structure of the upper and the lower jaw varies greatly in the degree of density. The arrangement and distribution of the tissues are uniformly constant although their character varies somewhat in different persons.[5]

The quality of the tissues has a marked influence on the stability of the artificial denture when it is subjected to functional stresses. The most satisfactory re-

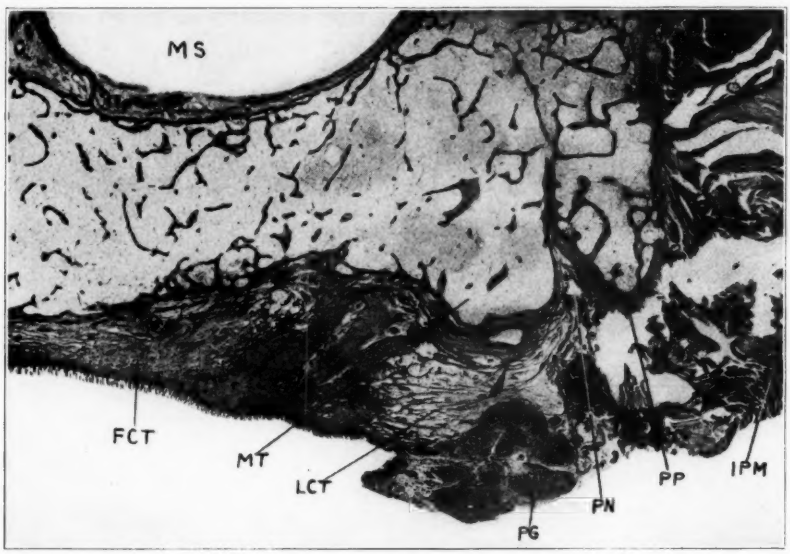


Fig. 8.—Anteroposterior section in maxillary tuberosity region of man, aged 62. *MS*, maxillary sinus; *FCT*, fibrous connective tissue; *MT*, maxillary tuberosity; *LCT*, loose connective tissue; *PG*, palatine glands; *PN*, pterygoid notch (pterygomaxillary notch); *PP*, pyramidal plate of palate bone; *IPM*, internal pterygoid muscle.

According to Wilson, "No one factor has so much to do with retention of artificial dentures as the soft tissues."[1] This principle is accepted as the premise in the

tention is assured when the soft tissues maintain contact with the entire area of the denture base. The denture base must be adapted to the tissues in each region of the denture area according to their

4. Leriche, R., and Policard, A. (trans. by Sherwood Moore and J. Albert Key): Normal and Pathological Physiology of Bone, St. Louis: The C. V. Mosby Company, 1928.

5. Pendleton, E. C.: Anatomy of Maxilla from Viewpoint of Full Denture Prosthesis, J.A.D.A., 19:543-572 (April) 1932.

capacity to accommodate themselves to the load imposed on them.

The regions in both the upper and the lower jaws subjected to the greatest stress during the function of artificial dentures are the residual alveolar ridges. The form and character of their structures are adaptable to the function imposed on them.

The bony process is firm yet cancellous enough to absorb shock. Its mucous covering is dense and well suited to withstand great stress.

The labiobuccal structures of both jaws are elastic, with an abundance of fat and glandular tissues about the muscle fibers. The mucosa in this region is well lubricated and maintains a quality that is ideal for creating a seal at the denture borders. This feature is char-

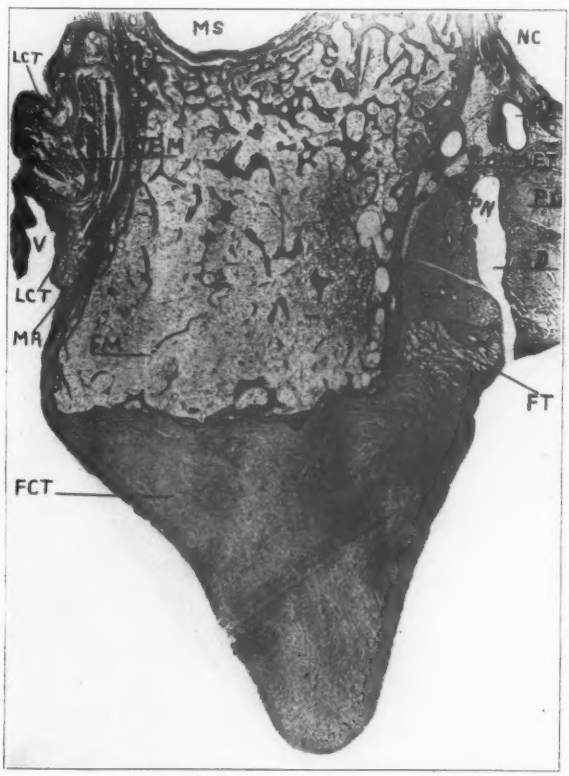


Fig. 9.—Buccolingual section in maxillary tuberosity region of woman, aged 58. *MS,* maxillary sinus; *LCT,* loose connective tissue; *BM,* buccinator muscle; *V,* vestibulum of cheek; *MA,* buccinator muscle attachment; *FM,* fat marrow; *FCT,* fibrous connective tissue; *FT,* fat tissue; *SD,* secretory duct; *PN,* palatine nerves; *PG,* palatine glands; *PA,* palatine artery; *NC,* nasal cavity.

acteristic of the tissues that form the floor of the mouth and of those that constitute the soft palate. Wherever valve seal is a requisite to denture stability, the structures seem to have a peculiar quality perfectly adapted to the scheme of denture retention.

The vault of the palate presents many hazards to the stability of the artificial denture, owing to its form and the varied character of its structures. It is important that the student of denture prosthesis have an intimate knowledge of these tissues.

The anatomic material was selected to exhibit the structures typical of the various regions of the upper jaw that are utilized for denture support. The specimens were chosen from subjects of various ages and from both sexes so that the consistency in tissue quality and distribution in the several regions might be emphasized.

Fig. 10.—Sagittal section in median line in central incisor region of upper jaw from woman, aged 58. *PPM,* palatine process of maxilla; *E,* oral epithelium; *FT,* fat tissue; *PR,* palatine rugae; *IC,* incisive canal; *FCT,* fibrous connective tissue; *RAR,* residual alveolar ridge; *MA,* lowest point of attachment of depressor alae nasi muscle; *MG,* mucous glands of lip; *LCT,* loose connective tissue; *DAN,* depressor alae nasi muscle; ANS, anterior nasal spine.

Figure 6 shows a section of the residual

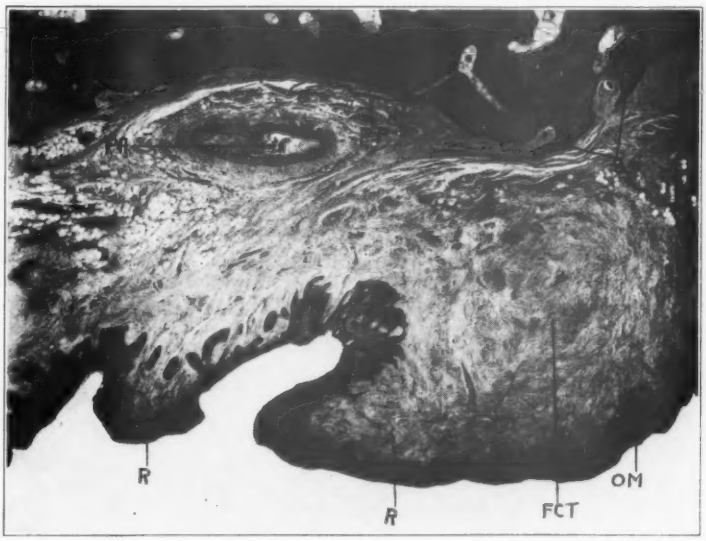


Fig. 11.—Sagittal section of inferior surface of palatine process of maxilla of woman, aged 58. *PP,* palatine process; *PA,* palatine artery; *S,* spinous process on inferior surface of palatine process; *OM,* oral epithelium; *FCT,* fibrous connective tissue; *R,* palatine rugae.

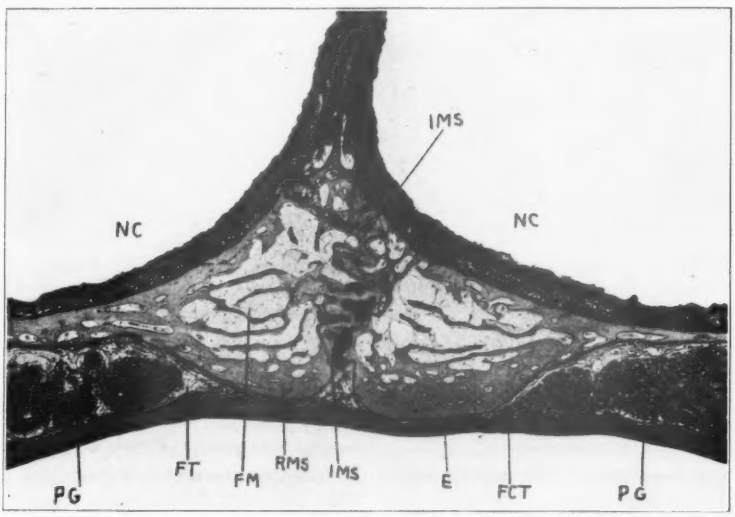


Fig. 12.—Frontal section in molar region at union of palatine processes of maxilla of woman, aged 51. *NC,* nasal cavity; *IMS,* intermaxillary suture; *PG,* palatine glands; *FT,* fat tissue; *FM,* fat marrow; *RMS,* ridge of intermaxillary suture; *E,* epithelium; *FCT,* fibrous connective tissue.

alveolar ridge from a man, aged 38, that is typical of the molar region. In Figure 7, a section from the bicuspid region from a woman, aged 51, shows the same general character and arrangement of structures. Figure 8 is a sagittal section in the tuberosity region from a man, aged 62, in which the character of the bone is in marked contrast to that in the preceding sections. In the oldest person examined, the trabeculae are fine and the marrow spaces are large. In the youngest person, the trabeculae are strong and the marrow spaces small. (The fact that the sections were prepared in a different plane in the young and in the older persons has no bearing on the character of the bone structure.) The mucosa covering the alveolar ridge of the upper jaw is normally dense and symmetrical except at the posterior extremity of the tuberosity region where loose connective tissue and glands are found beneath the epithelium at its lingual surface. Swenson refers to this region as the "pterygomaxillary notch."[6]

Figure 9 shows a section of the tuberosity region of a woman, aged 58. Covering this region is a pendulous area of dense fibrous connective tissue. Such a development of hyperplastic tissue is not uncommon in the mouths of edentulous persons. It presents a condition where surgical measures should usually be recommended before impressions are taken for full dentures as hyperplastic tissue is unstable and therefore not suited for denture support.

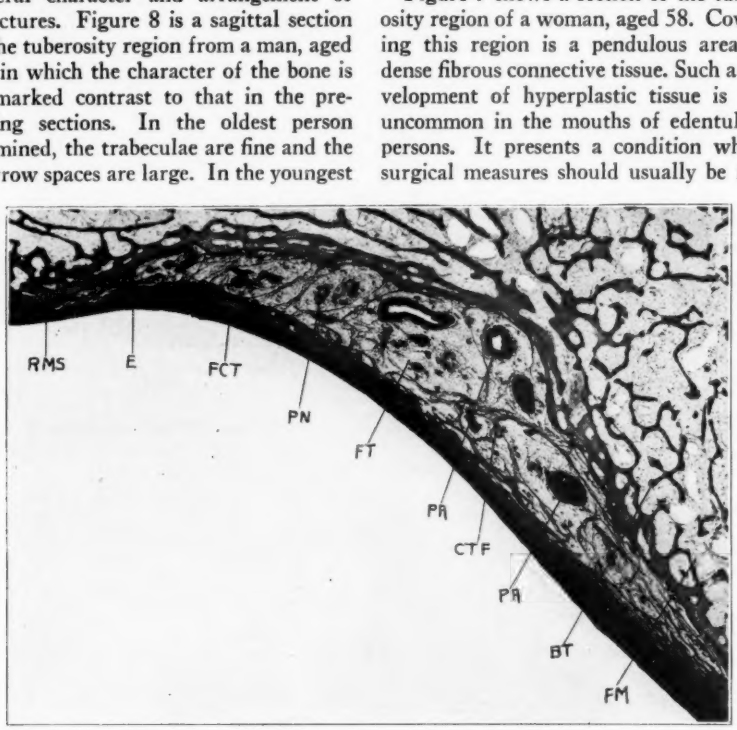


Fig. 13.—Frontal section in bicuspid region of woman, aged 51. *RMS*, ridge of intermaxillary suture; *E*, epithelium; *FCT*, fibrous connective tissue; *PN*, palatine nerves; *FT*, fat tissue; *PA*, palatine artery; *CTF*, connective tissue fibers; *BT*, bone trabeculae; *FM*, fat marrow.

Figure 10 is taken from the anterior portions of the alveolar ridge and palatine process in the median line. The

6. Swenson, M. G.: Anatomy in Relation to Edentulous Impressions, J.A.D.A., 20:1078-1082 (June) 1933.

mucosa in this region is firm and somewhat irregular. Some adipose tissue is found beneath the tunica propria linguad from the incisive foramen. On the labial surface of the ridge, the fibrous connective tissue is dense as high as the line of lip reflection, where the muscle attachments are seen. High in the incisive fossa toward the anterior nasal spine, there is a considerable quantity of loose areolar tissue supporting the fibers of the depressor alae nasi muscle. From clinical observations, it is known that the structures in this region are loose and elastic. The incisive fossa region presents an area that may be utilized to considerable advantage in denture retention provided its structures are not compressed to interfere with the functional movement of the labial muscles.

Figure 11 shows a higher magnification of the palatine rugae in the cuspid region from the same specimen. In mouths that present these highly developed folds in the mucosa, great care should be exercised in impression taking for denture construction. When these folds, compressed by a closely adapted denture, are irritated by movements of the denture during function, unfavorable reactions may result in these tissues. Dentures adapted to the palatine surfaces so closely as to produce continuous pressure on its tissues are not recommended. Impressions should not be taken in trays that confine the impression material to the extent of causing compression of the palatine structures. A close observation of the inferior surface of the palatine process shows many irregular projections,

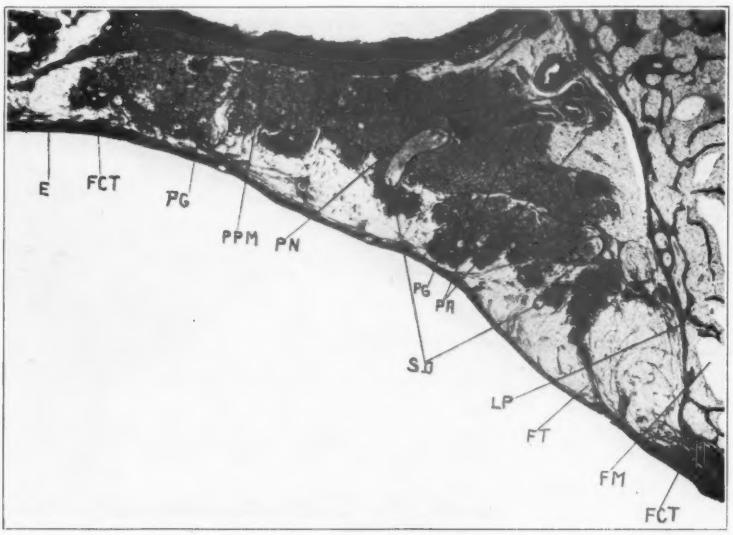


Fig. 14.—Frontal section in molar region of woman, aged 51. *E,* oral epithelium; *FCT,* fibrous connective tissue; *PG,* palatine glands; *PPM,* palatine process of maxilla; *PN,* palatine nerves; *SD,* secretory ducts; *LP,* lingual plate of residual alveolar ridge; *FM,* fat marrow; *FT,* fat tissue; *PA,* palatine artery.

as spines, that cause congestion of the soft tissue coverings when they are subjected to harsh treatment.

The ridge of the intermaxillary suture, commonly called the median raphe, is shown in Figure 12. The section was prepared from the molar region in a woman, aged 51. Thin, firm mucosa covers its surface. The size and the development of this ridge varies greatly in different persons and presents a region unfavorable to the stability of the artificial denture. On either side of the ridge of the intermaxillary suture, the tissues are soft.

Figure 15 shows a frontal section in the bicuspid region in a woman, aged 51, and presents a cross-section of the vault of the palate, alveolar ridges and buccal tissues in the maxillary denture area. In this region, the mucosa is quite thick and dense. The fatty submucosa increases in thickness in the posterior part of the mouth. The molar area presents a similar picture with the exception that the mucosa becomes thinner, the fat decreases in abundance and the mucous glands increase proportionately in size and number as sections are prepared from the posterior regions of the vault. If a cross-section of a full denture were superimposed upon this specimen, its palatine surface should, we may assume, rest in reciprocal contact with all of the inferior surface of the vault of the palate, alveolar ridges and buccal soft tissues. The difficulties experienced may well be understood in constructing artificial dentures that are supported by foundation structures so varied in form

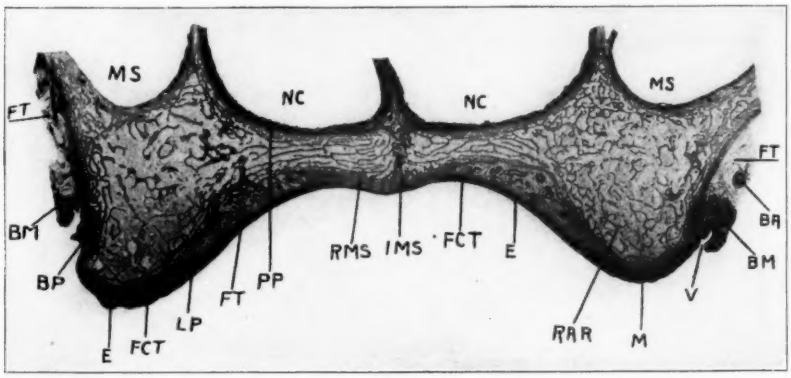


Fig. 15.—Frontal section in bicuspid region of upper jaw of woman, aged 51. *NC*, nasal cavities; *MS*, maxillary sinuses; *FT*, fat tissue; *BM*, buccinator muscle; *BP*, buccal plate of alveolar process; *E*, epithelium; *FCT*, fibrous connective tissue; *LP*, lingual plate of alveolar process; *PP*, palatine process of maxilla; *RMS*, ridge of intermaxillary suture; *IMS*, intermaxillary suture; *RAR*, residual alveolar ridge; *M*, mucosa; *V*, vestibulum; *BA*, buccinator artery.

Figure 13 shows the fat tissues in the bicuspid regions, and Figure 14 the glandular tissues in the molar regions between the ridge of the intermaxillary suture and the residual alveolar ridges. The structures in these regions are highly vascular. On clinical observation, they present an area that is resilient and usually compressible at the posterior portion of the vault of the palate.

and character and irregular in surface outline.

CONCLUSIONS

From the study of these and similar clinical records, together with the regular examination of many patients wearing complete maxillary and mandibular dentures, the following conclusions are offered:

The regional reactions of the supporting tissues to full dentures are influenced by the unequal distribution of functional stresses resulting from acquired habits in mastication, the signs of which are important in the diagnosis of conditions of the edentulous jaws.

The soft tissues are the index to the changes displayed by the bone structures supporting the full denture.

The preservation and functional adaptation of bone depends on the degree of mechanical action imposed on it. The result on the whole will vary according to predominance of the periods of pressure and rest.

Areas of hyperplastic tissue indicate resorption of bone and are found in regions diametrically and diagonally opposite to the areas subjected to "positive force."

The regions stimulated by the denture maintain normal form and appearance owing to the positive forces exerted in mastication.

The tissues of the mouth react favorably to artificial full dentures in those regions receiving a well-distributed load from the functional stresses.

Tissues subjected to "negative forces" usually show a reaction that indicates a degenerative or inflammatory process. The supporting bone diminishes and dense fibrous connective tissue develops to fill the space between the bone and the denture base. This tissue reaction is a pathologic process resulting from mechanical injury.

PROBLEM OF ESTABLISHING CENTRIC RELATION: ITS IMPORTANCE AND SOLUTION*

By I. L. FURNAS, D.D.S., Cleveland, Ohio

IN constructing artificial dentures, it can scarcely be said that any one step in the technic involved is more important than another. All are of equal importance and each must be carried out with accuracy and detail if the finished product is to function as desired.

The purpose of this treatise is to deal with but one phase of this technic, namely, that of establishing centric relation or, as it was originally termed, "taking the bite."

It has been variously estimated by operators in position to know that from 50 per cent to 80 per cent of the denture cases which must be reconstructed are failures because the operator did not establish the centric jaw relation.

The great variety of different methods employed throughout the profession to establish this relation is sufficient evidence in itself of the difficulties encountered by almost every operator in attempting to supply denture service.

*Read before the Section on Full Denture Prosthesis at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 7, 1934.

There are many definitions of centric relation, but surely one of the clearest is as follows: Centric relation is that positional relation of the mandible to the maxilla wherein the condyles are in their most retruded position in the glenoid fossae from which lateral movement starts.

Centric relation is often confused by many with centric occlusion, which we find to be an entirely different relation when we compare the definitions, centric occlusion being that positional relation of the mandible to the maxilla wherein the functioning cusp planes of the teeth are in maximum contact. Thus, we find centric relation to be a fixed, positional relation, while centric occlusion becomes a constantly changing relation influenced by age, abrasion, extraction and habit. This factor of difference becomes important when we later compare the various technics, or methods, of establishing centric relation used throughout the profession.

Time will not permit a detailed description of the various methods employed for establishing centric relation, or, "taking the bite," but I shall consider briefly a few of the more common technics in use. I hope to prove beyond any doubt that all of these methods except one are inaccurate, unreliable and only guesswork, and give the operator little, if any, information upon which he can construct his dentures.

One of the earliest methods used was to hold the head of the patient with the left arm and, with the patient's mouth open, apply a slow, steady pressure on the point of the chin with the right hand, at the same time slowly closing the jaws and forcing the condyles back in the glenoid fossae. The inaccuracy of this technic is too obvious for further comment.

One of the most popular technics used is that of having the patient place the tongue as far back in the throat as possible and close the mouth. We find many variations of this method. Some dentists advise that the patient's head be thrown as far back as possible during this action. Others place the patient in a recumbent position. Many more build a ridge of wax across the posterior portion of the upper bite-block from heel to heel and have the patient place the tongue back of this ridge and push during the act of closing. Here, again, we see a technic that gives no accurate information, leaving the operator believing that he is right, but with no accurate means of proving his belief.

Dr. Green developed a technic for establishing centric relation to be used in conjunction with his impression technic. Briefly it was about as follows: After the impressions and occlusion rims were finished, the patient sat perfectly still and held the bite-blocks open not more than one-eighth inch. Holding the jaw in that position for a period of minutes, the muscles become tired and relaxed. When the muscles relax, the mandible is supposed to drift to a rest position and the jaw is closed for the patient by the operator. This technic may, in some instances, give the desired results, but cannot be relied on.

There is another technic used whereby the patient closes the jaw without the least resistance or stress and then employs a chopping motion to aid in locating the rest position.

A technic known as the "temporal test" is quite popular in certain sections of the country. Here, the patient is asked to close under pressure with the finished bite-blocks in position. If the temporal muscle is felt to contract, it is assumed that the mandible is in centric relation. This is based on the theory that when natural teeth are in the mouth and the mandible is protruded, or thrown later-

ally, the temporal muscle cannot be contracted. This condition does not prevail when the natural teeth are padded, or when bite-blocks are in the mouth, and is, therefore, one of the most misleading and unreliable of all the tests used.

Another technic used by some is briefly described as follows: The bite-blocks are completed and placed in the mouth. The patient is then requested to leave the operating chair and assume an upright, standing position at a convenient place in the office. It is important that no mention is made to the patient about "closing" or "biting" in any way, the idea being to convey the impression that the operator is only interested in the height, fullness and general esthetic values of the case. The patient will at first show signs of feeling that the bite-blocks are clumsy, or falling, and will try to overcome this by a tenseness of the muscles of the lips. This can be overcome by having the patient talk freely or read something from a paper or magazine out loud. As soon as the muscles seem to be thoroughly relaxed, the patient is instructed to assume a comfortable, relaxed posture, bringing the lips into contact, but without biting or bringing the bite-blocks together; in other words, assuming the rest bite position. The patient is now asked to moisten the lips with the tongue and to swallow. Just as he unconsciously closes the bite-blocks to perform the act of swallowing, the operator firmly grasps the head and mandible, holding them in that exact position, and makes two vertical guide lines in the wax or compound, one on either side crossing the horizontal occlusal plane in the region of the first bicuspid. The patient is now returned to the operating chair and asked to open wide and close. It will more than likely be noted at this time that the vertical guide line is broken at its intersection with the occlusal plane and that the lower jaw has been thrust forward. The patient is now asked to open very wide and close repeatedly until instructed to stop. At first, the vertical guide line will remain broken at the occlusal plane, but as the patient continues this action and the muscles of the jaw become tired, a slow but gradual relaxation takes place and the guide line gradually becomes united at the occlusal plane. The patient will continue to work in this position indefinitely, thus showing that this is the working position for the case.

While this method is a very good one, it falls far short of telling the whole story and cannot be relied on for accurate results in all cases. It has a further disadvantage of consuming time; which is always an important factor in any practice.

The methods here enumerated by no means cover the entire list employed, but most of the other technics are either similar to, or variations of, one of the examples described above. As previously stated, all are, in my opinion, unreliable and unworthy of use in modern denture construction.

A method which seems to meet every requirement has the following advantages:

It is applicable in practically every edentulous case.

It not only shows accurately and definitely the exact point of centric relation, but also presents a perfect picture, pointing out habitual or acquired functional positions of importance, unusual or limited forms of movement and acquired malformation due to the lack of dentures or the wearing of ill-fitting dentures, and can be used quickly and with ease on any normal, and most abnormal, edentulous patients.

The time consumed in its use is no more than that used in most other methods and much less than that required by some. If the time consumed in "spot grinding," or "milling," and so-called

"after treatments," all, or mostly, due to faulty centric relation, is counted, this technic can be considered a valuable time-saver in any office where dentures are constructed.

All of the equipment needed for this technic will be found in any modern dental office, with the possible exception of one small appliance costing about $1.

It can be used on any kind of articulator ranging from the simplest plain line to the most complicated instrument.

It is a simplified technic for using the gothic arch tracing, first described by an English dentist, and later given a practical application in denture construction by Gysi. This simple tracing has so frequently been identified and combined with long and complicated denture construction technics that it has itself become clothed with an air of mystery to some, and many have neglected its use for this reason.

If we consider the mandible as a simple, equilateral triangle, having its base a line drawn from condyle to condyle, and its apex at the contact point of the two lower central incisors, it will be easier to understand this simple movement. If we now hold the angle at one condyle in that position and rotate the apex, we will describe a circle. If the opposite condyle angle is held and the apex again rotated around it, we will have another circle, and these two circles will overlap, or their lines will cross, or intersect at the apex of the triangle. The lines forming this intersection are, of course, curved, but, for all practical purposes, we consider them as straight lines and the angle thus formed as the extreme of mandibular movement.

This is exactly what is produced in a practical case when a tracing is made of the jaw movements. The angle of this tracing varies from about 80 to 120 degrees. At times, the apex, or point, of the tracing is flattened or squared off; which shows that the condyles have assumed a new and forward position, usually due to abrasion, extraction or the wearing of ill-fitting dentures when the bite has been abnormally closed. This is information of importance and obtainable only by this technic.

Perhaps the greatest value is in the case wherein the patient describes a perfect tracing and then the dentures continually function at some point within the tracing other than at its apex. This condition exists in perhaps 50 per cent of all cases. By any other method, this acquired, or habitual, position appears as the point of centric relation, but, from the standpoint of function, this is by no means the case. If this acquired point is accepted as centric relation, when the dentures are finished, it becomes necessary to do no end of "milling," "spot grinding" and "after treating," in order to avoid trauma and soreness and make the dentures function at least partially and comfortably.

When a set of dentures is constructed on such a basis, the functional movements are restricted, or limited, to almost 50 per cent of their normal range. This, and not the correct position, is the one usually recorded by all other methods of establishing centric relation, and the operator has no possible way of knowing which position the patient has given.

There are a small percentage of patients who have the power of retruding the mandible beyond the point of centric relation as indicated by the gothic arch tracing. In such cases, it is impossible to detect this movement by any other technic. Again, if the position given by the patient is accepted, the finished dentures will require much careful grinding before they will function comfortably.

Grinding dentures to occlusion is not always a safe procedure. Many times,

they will seem comfortable to the patient and appear satisfactory to the operator, and still are in traumatic occlusion to a degree to stimulate sufficient tissue change to cause very serious results.

There is much more that could be said in favor of the gothic arch tracing. It seems sufficient to say that this tracing gives the operator a perfect picture of conditions exactly as they exist, whether they be normal or abnormal, natural or acquired, and eliminates completely all the elements of guesswork in this very important step of denture construction.

There are a few points whereat caution must be exercised in using this technic: 1. When the tracing has been completed and the pin is resting at the apex, the bite-blocks must be securely fastened together in the mouth in that exact position. If the heels of the bite-blocks are permitted to move or rotate, the record is of no value.

2. The bite-blocks must not move during the time the tracing is being made. This may be avoided (1) by constructing accurately fitting bite-blocks and (2) using an adhesive powder on the bite-blocks. In case there should be a slight movement, it is easily detected by the irregular lines of the tracing. The equipment needed for this technic is one piece of 24-gage brass plate, 1 inch square, and one Gysi gothic arch marker.

The brass plate is cut in the form of a circle about the size of a 25 cent piece, and having an extension on one side about one-half inch wide and about one-fourth inch long. This projection is bent at right angles at the circumference of the circle. A match stick is now dipped in oil of cloves and ignited in the flame, and the upper portion of the brass disk coated with carbon from the burning oil of cloves. A small piece of baseplate wax, slightly larger than the head of a pin, is now placed on the carbon coating and held in the flame until it is melted and evenly distributed over the entire surface, acting as a fixing, or retaining, agent for the carbon. It is now ready for use.

In describing the technic for making this tracing, let us go back one step to the mounting of the casts on the instrument. I do not believe that the facebow is absolutely essential to the construction of efficient dentures, but I do believe that if it is used, much trouble may be avoided and considerable time saved. The facebow is used for one purpose, and one purpose only, and that is to establish the correct altitude of the Bonwell triangle, or the anterior posterior relation of the upper cast on the articulator. Its use is simple and requires little time.

The bite-fork of the facebow is warmed and inserted in the upper bite-block at the median line and parallel to the occlusal plane. The bite-block is now placed in the mouth with the stem of the fork extending from between the lips at the median line. The facebow is now centered over the face, engaging the stem of the bite-fork and the sliding bar lugs located over the heads of the condyles. While the bite-block is held in this position the patient tightens the set screw on the bite-fork stem. The sliding bar lugs are now pushed outward and the entire case removed from the patient and transferred to the articulator, where the upper cast is mounted.

The bite-fork is now removed from the upper bite-block and the gothic arch marker attached in its place at the median line.

The lower bite-block is now fused in the anterior portion with a hot wax spatula and the tail piece of the brass plate tracing table inserted in the fused area, care being observed to keep the table parallel to the occlusal plane. The bite-blocks are now placed in the mouth,

and the tracing pin is engaged and the tracing made.

I believe that, in making the tracing, the protrusive movement should be recorded first, in the average case, because it is easiest for the patient, and then either the right or left tracing, and then completed.

With the pin of the tracer at the apex of the tracing, the bite-blocks are firmly attached to each other in this relation in the patient's mouth. They are then loosened from all adaptation, and the patient slowly forces them from the mouth with the tongue and they are received by the operator.

The bite-blocks fixed in this relation are now placed in position on the upper cast, which has previously been mounted on the articulator, and the lower cast is placed in position and mounted.

The gothic arch marker and the tracing table are now removed and we are ready to proceed with the setting up of the teeth.

This technic is so simple and such a timesaver, and eliminates so much difficulty in the construction of artificial dentures, that it is indeed hard to understand why it is not in universal practice.

The National Society of Denture Prosthetists has studiously avoided adopting or sponsoring any individual technic for denture construction, but they have unanimously adopted the gothic arch tracing as the one and only means of definitely and accurately establishing centric relation.

The purpose of this paper is to show, if possible, the simplicity, accuracy and universal application of this technic, and to urge you who are not already doing so to use it in your various denture technics.

I have made no attempt to discuss the different variations of the gothic arch tracing, such as those employed by Needles, Stansbery, House and others. They are all good and will give accurate results.

The desire back of this presentation has been to remove every trace of mystery from the gothic arch tracing, and to give something of practical value to you to take home and put into practical application.

I am fully aware of the fact that many men are successfully using this technic, and I also know that there are still some who are not using it, and I appeal to the latter group to make it a part of their denture technic. The day of the old "mush bite" is so far gone that the term "ancient history" hardly describes it. Any method or means that will lessen the burden of the operator, and at the same time increase the efficiency and comfort of the dentures, should be employed.

It is the professional and moral obligation of every dentist to keep pace with the advancement of his profession.

THE VALUE OF ROUTINE RADIODONTIC EXAMINATIONS*

By CLARENCE O. SIMPSON, M.D., D.D.S., F.A.C.D., St. Louis, Mo.

DENTISTS who have defective vision and are barely able to see the teeth and gums of their patients should use spectacles instead of fumbling and guessing. Just any spectacles will not serve, but they should be correctly made for the purpose, to give clear vision. The spectacles should be used for the examination of every patient and not reserved for unusual conditions, because the essential information cannot be had without them. The truth of these statements is too obvious for discussion.

Equally true and obvious, the vision of all dentists is deficient in being able to see only the exposed surfaces of the teeth and gums, which are only a slight part of the dental structures. Therefore, all dentists should use radiodontic aid to extend their vision instead of fumbling and guessing. Just any radiodontic examination will not serve, but it must be correctly made for the purpose, to give clear vision. Routine examination should be used for the examination of every patient and not reserved for unusual conditions, because the essential information cannot be had without it.

Radiodontic equipment has been in 25,000 dental offices for periods averaging more than five years, but most dentists have not learned to utilize it. As the most expensive piece of furniture, it usually stands a neglected monument to salesmanship and supercharged dentistry. It is unfolded only on rare occasions, when it may prove more a liability than an asset. The reasons for this are that the novelty has passed, the procedure requires special effort and there is a lack of confidence in the result.

Consequently, dental diagnosis is too often a sporting event, with the patient unknowingly taking a chance at unfavorable odds. The daring diagnostician peeps at the mouth, pecks at the teeth and plunges into treatment, for the success of which the patient should pray. Most of these dental clairvoyants are one-tooth minded. Ignoring the frequency of reflex pain and deceptive symptoms, they concentrate on one tooth unless compelled to extend the field. Evidently, to obtain all possible information for a correct diagnosis is too prosaic, when it is so exciting to apply experimental treatment and see what happens.

Nature is kind, but may not be able to conquer both the disease and the wrong treatment. A large proportion of unprofitable operations, prolonged treatments and ultimate failures are the result of incorrect diagnoses. The time and effort required for thorough examinations are insignificant in comparison to that wasted by diagnostic and operative errors due to neglect of the available information. Excepting superficial lesions, radiodontic examinations will supply about 80 per cent of the evidence for dental diagnoses. No dentist can disregard this with-

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 7, 1934.

out injustice to himself and his patients.

Radiodontia is a means of extending dental examinations to their rational scope by revealing the internal structures of the teeth and alveolar processes. Whether or not internal abnormalities and complications are suspected, the possibility warrants investigation. The value of the examination is not reduced when no unusual factor is found, because conditions could not be determined without it. A differential diagnosis is often established by a process of exclusion.

The only method by which the greatest assistance can be secured from radiodontia is to employ it as a routine procedure. Whenever there is an occasion for a mirror and explorer examination, the dentist should realize that it is only a superficial inspection, comparable to the physician's looking at the tongue and then making a diagnosis. An adequate dental inspection must include radiodontia.

Each new patient coming into a dentist's practice should have a general radiodontic examination, because the conditions and requirements can be determined in no other way. Upon the basis of the amount of dental repair and evident susceptibility, each patient should have a general radiodontic examination at periods ranging from six months to two years. These periodic examinations are especially indicated in the transitional and susceptible age from 6 to 25 years.

When a local disturbance or injury occurs, a regional radiodontic examination of sufficient extent to include all factors should be made. This is inclusive of several adjacent teeth, and when there is a possibility of reflex symptoms, the opposing teeth. The result of treatment and operations should be kept under observation by subsequent examinations at appropriate intervals. It is preferable to make periodic inspections more often than necessary rather than to neglect them.

It is excusable for the laity to believe that radiodontic examinations are only for the purpose of finding abscessed teeth, but dentists should appreciate the greater service of dental conservation. The discovery of caries, incipient periodontoclasia and defective restorations is indispensable to efficient dentistry. The diagnosis of painless pulp degeneration and the presence of septic crypts is a major health service. Information regarding the congenital absence of teeth and the presence of supernumerary and impacted teeth is a means of preventing malocclusion. These are some of the contributions of routine radiodontia.

Just imitating the movements of a radiodontic examination does not serve the purpose. The evidence must be clearly registered in different views for verification or modification. This can be accomplished only by exacting technical procedure, for which wrestling the patient and shooting promiscuously are not a substitute. The hazy, distorted images which are generally produced cannot be interpreted accurately and are misleading. This prevalent deficiency demonstrates the need of intensive technical training in radiodontia, which might be acquired by a correspondence course of instruction.

A common excuse for not making routine radiodontic examinations is that their importance is not understood by patients. This is usually because the dentist does not understand or explain their importance. If the patient is truthfully told that no one can determine conditions without radiographs of the teeth and bone, the importance is understood and unlikely to be questioned.

The economic benefits of routine radiodontia far exceed the cost. The value of the comfort, appearance and function of natural teeth cannot be appraised. The saving in extensive repairs,

prolonged treatment and the replacement of teeth amply compensates for the expenditure in avoiding them. The argument is so conclusively in favor of routine radiodontia that it would appear superfluous to discuss it. So in all branches of practice, the value of established procedure is evident but generally neglected. The advertising slogan this year was "Plan your vacation to attend a scientific meeting." We have had a three-year vacation without planning it, and why attend a scientific meeting when such a small part of the accumulated science of dentistry is generally applied? Why not plan and attend to practice scientifically and not have a permanent vacation?

DISCUSSION

Louis M. Cruttenden, St. Paul, Minn.: I recall very definitely ten or fifteen years ago when the excuse used by most dentists for not taking more x-ray pictures was that very few had machines and the patients had to be sent to either a physician or somebody else who had a machine. It was supposed to be very inconvenient. Doctor Simpson makes the statement that there are now 25,000 dental offices that have x-ray machines. The increase in the radiodontic service which is rendered to the public is still greatly short of what it should be. Also, I would like to bring out the point of equipment. Manufacturers have produced a very effective machine which can render an efficient service in the hands of most dentists. After the radiographs are taken, the matter of processing seems to be slighted. Processing the x-ray films is a very important procedure. Improperly done, it constitutes a great waste. From a diagnostic standpoint, many films are ruined, and the x-rays are hailed as not showing the condition which later is found to exist. Whether or not the time and temperature development method or the inspection method is used, both require good chemicals and fresh solutions. Dark rooms are frequently found to contain light leaks, which as everyone knows will not add to the clearness of the radiogram. I do not believe that there is a dentist who is willing to entrust the visual examination of a patient's mouth to his assistant. That seems to be a "holy ground" in which the dentist feels that he alone may tread. However, when the x-ray examination is brought out, he is perfectly willing to allow his assistant to make that examination. In my experience, I have never seen a complete radiodontic examination of a case made by an assistant that is adequate.

Vern D. Irwin, Duluth, Minn.: Once the value of a single general radiodontic examination is appreciated by the dentist and patient, little mental effort on the part of either should be required to appreciate routine radiodontic examinations. There is little background for the belief that patients are unwilling to follow professional suggestion. True, they are often too ready to subscribe to something to which is attached considerable hokum, but it is likewise true that once the dentist himself is sold on the value of something, his evident sincerity and enthusiasm easily convince the patient of the merit and necessity of his suggestions. Dr. Simpson has given you nothing that he has not presented to the profession many times before. He is much like a preacher bringing frequent messages of truth to a sinning congregation. Without routine radiodontic examination, we are limiting the possibility of rendering major health service. That we "peek in the mouth, peck at the teeth and plunge into treatment" is an indictment against our conscious effort to render major health service. A general shake-up in our attitude toward this important phase of dentistry is needed. The use of radiodontia should be extended to include, for instance, insurance examinations. It is incredible that life insurance companies do not insist on a complete radiodontic examination in addition to the routine medical examination. Few state boards of dental examiners require the student to make a radiodontic examination of his patient at the time of the examination, and few require radiodontic interpretation in examination for license to practice. Then might be a good time to impress on the young

dentist the importance of radiodontia. The routine use of bitewing radiographs is so essential that it may be stated that to practice dentistry without their constant use is doing the patient and dentist a great injustice. If you cannot agree with Dr. Simpson that a routine general radiodontic examination is necessary, you must surely concur that routine bitewing radiographs are indispensable. The general health and welfare of the patient require frequent radiodontic attention. Residual infection in edentulous areas and periodontoclasia which has progressed far into the bifurcation of molar teeth are major disease factors and so should be discovered and taken care of. Bitewings do not always show either of these conditions. The routine radiodontic examination is the safest for the patient, the surest for the dentist, and the sanest procedure for the profession to adopt in its combat of human ills and discomfort.

STUDIES IN THE RAT OF SUSCEPTIBILITY TO DENTAL CARIES: A REVIEW OF FOUR YEARS OF RESEARCH*

By THEODOR ROSEBURY, D.D.S.; MAXWELL KARSHAN, Ph.D., and GENEVIEVE FOLEY, M.A., New York City

WHEN the group research in dental caries was started at Columbia University in February, 1930, under a grant from the Commonwealth Fund, one of the most urgent needs in the field appeared to be the development of means for producing dental caries experimentally in a laboratory animal. Studies on human subjects are necessarily limited in scope to a greater extent than are animal studies, and the former do not permit of the rigid control possible with animals. It is not practicable, for example, to attempt deliberately to produce dental caries in human beings, partly for humanitarian reasons, and partly because the great mass of human beings already have the disease; so that one is obliged to work backward, as it were, toward a means of prevention. In animals, on the other hand, after it becomes possible to produce a pathologic condition experimentally, the disease can then be subjected to rigorous analysis; and if the experimental disease is sufficiently similar to that in man to make it probable that they result from the same or similar causes, the experimental analysis may be expected to illuminate the problem of the human disease. Our objectives from the start have thus been two: (1) the pro-

*Read at the Seventieth Midwinter Clinic of the Chicago Dental Society, Feb. 28, 1934.

*From the Departments of Bacteriology and Biological Chemistry, College of Physicians and Surgeons, and School of Dental and Oral Surgery, Columbia University.

*Many details of these studies are omitted from this review, which attempts to correlate the investigation as a whole. The separate reports in this series furnishing these details and also photomicrographs of the pathologic changes and lesions described are: (a) Rosebury, Theodor, and Karshan, Maxwell: J. D. Res., 11:121. 137 (Feb.) 1931. (b) Rosebury, Theodor, and Foley, Genevieve: J. D. Res., 12:462 (June) 1932; to be published, 1934. (c) Rosebury, Theodor; Karshan, Maxwell, and Foley, Genevieve: J. D. Res., 12:464 (June) 1932; (d) 13:379 (Oct.) 1933; (e) Studies in Rat of Susceptibility to Dental Caries. IV. Further Studies of Etiology of Dental Caries, J.A.D.A., 21:1599 (Sept.) 1934.

duction of an experimental disease similar to dental caries in man, and (2) an analysis of the causative and conditioning factors in the experimental disease. The first objective has, we believe, been attained; the second is being pursued. In this report, we present a résumé of these experiments up to the present, including our earlier attempts to produce dental caries which did not accomplish their object.

The literature available when this work began contained several reports of the experimental production of dental lesions in laboratory animals, including guinea pigs,[1] rats[2] and monkeys.[3] Of the readily available animals, rats appeared to be most suitable for this purpose. The teeth of rabbits and guinea-pigs all have persistently growing roots, and thus are unlike the teeth of man. In rats, the incisor teeth are also of this type, but the molars are very similar to human molars, both in manner of development and in the disposition and structure of the dental tissues. The occlusal surface of the rat molar presents a series of deep lateral grooves or fissures lined with enamel. These fissures serve as sites for the stagnation of food débris, and thus resemble the fissures of human teeth. The rat molars are, on the other hand, monophyodont, and differ from the teeth of man in certain other respects which are described in the body of this paper.

The conclusions in the available literature regarding the causes of the dental lesions produced were somewhat contradictory, and did not suggest a clear lead for further experimentation. Dietary deficiency or imbalance of calcium and vitamin D was most commonly regarded as a factor in the production of the lesions, and, among other possible factors, deficiency of vitamin C appeared prominently. Our first two studies were based in part on these indications; but this work did not result in the production of dental caries. These earlier studies nevertheless yielded a background of information on the normal and pathologic characteristics of the teeth of rats which proved valuable in the experiments that followed. In the third study, typical dental caries closely resembling occlusal (fissure) caries in man was successfully produced. This finding made it possible, for the first time, adequately to define the pathology of the experimental lesion, and to distinguish it clearly from other dental lesions in rats. The successful production of experimental dental caries thus opened a promising field for investigation. A fourth series of experiments along this line is included in the description of these studies, which follows.

NEGATIVE EXPERIMENTS

The first study undertaken was as follows: Sixty young rats were divided into three groups and placed, respectively, on a low calcium, vitamin D-free diet, a vitamin C-free diet (employed in the thought that rat teeth may be sensitive to dietary deficiency of this vitamin al-

1. Howe, P. R.: (a) D. Cosmos, 62:586 (May) 1920; (b) 63:1086 (Nov.) 1921; (c) J. D. Res., 3:7 (March) 1921; (d) Further Studies of Effect of Diet on Teeth and Bones, J.A.D.A., 10:201 (March) 1923.

2. (a) Bunting, R. W.: D. Cosmos, 67:771 (Aug.) 1925. (b) Grieves, C. J.: Preliminary Study of Gross Maxillary and Dental Defects in 300 Rats on Deficient and Defective Diets, J.A.D.A., 9:647 (June) 1922; Effects of Defective Diets on Teeth, ibid., 10:573 (July) 1923. (c) McCollum, E. V., et al.: Johns Hopkins Hosp. Bull., 33:202 (June) 1922. (d) Macomber, Donald: J.A.M.A., 88:6 (Jan. 1) 1927. (e) Marshall, J. A.: Dental Caries and Pulp Sequelae from Experimental Diets, J.A.D.A., 14:3 (Jan.) 1927. (f) Shibata, M.: J. Exper. Med., 7:247 (April 10) 1929.

3. Howe, P. R.: Footnote 1, reference d; Studies of Dental Disorders Following Experimental Feeding with Monkeys, J.A.D.A., 11:1149 (Dec.) 1924.

though the animal in general is not), and a diet with a high level of carbohydrate. Litter mates in each of these groups were placed on comparable normal diets. All diets consisted of relatively simple substances rather than of so-called "natural" foods whose composition is less accurately known. Each group was further subdivided so that one-half the animals were fed a culture of human oral lactobacilli, suspended in an adhesive paste prepared from gum tragacanth, while the other half were fed the paste without bacteria. It was observed in these rats that aciduric bacteria similar to *Lactobacillus acidophilus* were constantly present among the mouth flora, independently of the feeding of the organisms obtained from human mouths. These animals were continued on the experimental diets for from forty to sixty days, a period sufficiently long for the development of marked pathologic changes in the teeth. Sections of the teeth of all animals were examined microscopically, and evidence of the retention of food in the fissures of the molar teeth was abundant. No dental caries occurred. It thus appeared that the combination of conditions studied, including either dental structural defects or an abundance of carbohydrate in the diet, combined in either case with food stagnation in the molar fissures and the presence in the mouth of aciduric bacteria, was not in itself sufficient to produce dental caries during the period of the test.

The pathologic changes produced in the teeth by the low calcium, vitamin D-free diet in the preceding study did not include appreciable alteration in the enamel of the molars. The form of this tissue seems to be established in the rat too early in life to be affected by conditions operating in the growing animal. If dental structure influences susceptibility to dental caries, the enamel should be the most important tissue involved, since it constitutes the first line of defense against the process. An attempt was therefore made to alter the structure of the enamel of the rat molar by feeding diets deficient in calcium and vitamin D during pregnancy and lactation, and then continuing the young under the same dietary conditions. The basal diet em-

TABLE 1.—COMPARATIVE EFFECTS OF DEFICIENT DIETS AND ADEQUATE DIETS ON THE PRODUCTION OF FISSURE CARIES IN RATS

	Number of Animals	Experimental Period Days*	First Caries Days	Fissure Caries				Average Lesion*			Index*
				Animals		Teeth					
				Number	Per Cent	Number	Per Cent	1 m.	2 m.	3 m.	
Eleven deficient diet groups	82	35–154	24–48	77	94	150	61	3.1	4.0	6.0	8.3
Six adequate diet groups	41	40–319	53–100	21	51	39	32	2.4	3.0	2.5	3.3
Diet 16 (adequate)	9	71–319	100	8	89	17	63	5.1	3.4	3.5	9.0

*These tables include only animals maintained on the experimental diets thirty-five days or more. The values for carious teeth are based on histologic examination of three lower molars (one side of one jaw) per animal. The "average lesion" is the total score for a given tooth in the group, divided by the number of those teeth which were carious. The "index" is the total score for the group divided by the number of animals in the group.

ployed was similar to that previously used, but somewhat less extreme. This diet was given to three groups of animals with varying supplements of vitamin D: one group had none of this vitamin, another received a subminimal dosage and a third received a supposedly optimal dosage. A fourth group was maintained on an adequate breeding diet as a normal control. In the first group, which received the low calcium diet without vitamin D, the young all died at or soon after birth. In the other groups, the litters survived. The control mothers showed a slight gain in weight during lactation, corresponding with the normal increase during the period for their age. The mothers receiving the deficient diet with normal vitamin D showed a slight loss in weight during lactation. The third group, receiving the deficient diet with subnormal vitamin D, showed a marked loss in weight. The experiment comprised eighteen mothers and a total of 107 young, all subjected to histologic analysis. Some of the mothers were killed after weaning their litters; others, in each group, were maintained under their breeding conditions for an additional 100-day period. The young in the three surviving groups were distributed at weaning time among nine subgroups in such a way as to test the combination of each set of breeding conditions with each set of post-weaning conditions. The latter consisted of the use of the normal control diet, and the two experimental diets without additions and supplemented, respectively, with dextrose fed separately *ad libitum,* gum tragacanth powder to promote adhesiveness and sodium carbonate to provide an immediate alkaline reaction in an attempt to increase the mucin content of the saliva. The mortality in the various subgroups corresponded closely with the recognized severity of the dietary conditions. It was noteworthy that the young transferred at weaning from a poorer to an improved diet grew notably better and suffered a lower mortality than those transferred from a better to an impaired diet. The effect of the dietary deficiency operating before weaning, therefore, was not permanent, being offset by the subsequent restoration of a more adequate diet.

Histologic analysis of the teeth of both mothers and young failed to reveal any dental caries. A lesion in the dentin at the summit of the molar cusps, apparently not analogous to dental caries, was observed in a few instances, so scattered among the experimental groups as to preclude any correlation with the various conditions of test employed. As in the previous study, evidence of impaction of food in the molar fissures was plentiful, and lactobacilli were constantly found in the mouths of the animals. Likewise, the pathologic changes observed in the teeth and bones of the rats that had received deficient diets were characteristic and could be directly attributed to the dietary conditions. These are described in the following paragraphs.

DENTAL DISEASE ASSOCIATED WITH CALCIUM AND VITAMIN D DEFICIENCY

The pathologic study made incidentally to the two investigations outlined above proved of value in the later studies. The interpretation of these pathologic findings was facilitated by the use of diets composed of relatively simple substances and of suitable controls. The characteristics of the animals that received the stock breeding diet were accepted as normal, and pathologic changes were estimated by reference to this normal standard. All of the changes described occurred consistently in the animals that received the deficient diets, and were consistently absent in the controls on adequate diets. The histologic

picture of the dental change produced by diets deficient in both calcium and vitamin D is characteristic and it differs from that which occurs on low phosphorus diets or on low calcium diets containing vitamin D. These circumstances make it possible to determine the presence and character of such a dietary deficiency from the pathologic conditions of the teeth. In the later studies with deficient caries-producing diets, necessarily composed largely of "natural" foods, similar pathologic changes were found. It was then possible to interpret these changes with assurance on the basis of the earlier findings.

(The rat incisor is a curved cylinder of uniform diameter, undifferentiated into root and crown over its length. The distal portion, or functional root, contains the pulp, forming dentin, and the enamel organ on the more external surface. The proximal portion, the functional crown, consists of a solid mass of dentin with a layer of enamel on the external surface, and terminates in a chisel-edge maintained by wear against the opposing incisor. The pulp forms dentin persistently over its entire surface, and so progressively closes off the pulp chamber at the incisal end of the erupting tooth. The enamel organ at its most distal end produces an uncalcified enamel matrix; more proximally, this becomes progressively calcified, and the enamel organ disappears. The rat molars are differentiated into roots, covered with cementum, and crown, covered except for the cusp summits with enamel. In the forming unerupted molar, the ameloblasts, instead of being continuous over the cusps as in human teeth, terminate near the summit of each cusp, leaving the dentin at the summit uncovered. As in human teeth, the enamel organ undergoes degeneration and ceases to function as the tooth erupts. The molars show no persistent growth except, as in man, for dentin formation by the pulp, which apparently proceeds at a continuously decreasing rate, and causes encroachment of the pulp approaching obliteration of the pulp chamber. In rat molars, this process is relatively rapid, and probably produces the appearance of compression seen in the pulp stroma. In the adult animal, this stroma consists of elongated cells whose nuclei lie roughly parallel to the dentin walls. It is noteworthy, and perhaps due to the same condition, that the odontoblasts of the normal molar lack the regularity seen in the incisor.

The most characteristic dental change is that which results from a deficiency of both calcium and vitamin D. In both incisors and molars, calcification of the dentin formed during the period of deficient feeding is impaired.

Such defective dentin, or dentinoid, is more eosinophilic than the normal tissue, and appears as a well-defined pink band occurring between the normal dentin and the pulp chamber, or, in other words, as a broadening of the zone of predentin seen in normally calcified teeth. On diets deficient in calcium and vitamin D, the tubular structure of this defective tissue is not altered. The dentinoid occurs as a layer of tissue varying in thickness with the duration of deficient feeding, but, in both molars and incisors, nearly uniform in thickness over the extent of the pulpal surface of the dentin. In the incisors, a variable amount of "globulation"—the formation of islands of normal dentin separated by dentinoid—may or may not occur. The odontoblasts ordinarily show no structural alteration. The pulp as a whole may appear entirely normal, or may show slight localized changes, consisting of enlargement of the nuclei of the stroma cells, and an increased granularity of the basic substance. A more severe pulp change

has been directly correlated with spontaneous death during experimental feeding. In this instance, the nuclei of the stroma cells are shrunken and rounded, the odontoblasts are locally or generally fibrotic, or may be replaced entirely by small round cells, and a variable amount of hemorrhage is present. On the low calcium, low vitamin D diets, the incisal enamel becomes hypoplastic. The youngest enamel, in the posterior portion of the incisor, shows this change first. Its normally perfect regularity is lost, its outline becomes undulant or irregular, the structure of the matrix is correspondingly deformed as though by an uneven collapse and the ameloblasts become cuboidal and disorderly. As the experimental period is prolonged, the calcified enamel more anteriorly shows these hypoplastic changes; in animals born and reared on a defective diet, the enamel may be hypoplastic throughout its extent. Otherwise, the enamel formed before the period of deficient feeding shows no structural alteration.

In the molars, the pathologic picture produced by dietary deficiency of calcium and vitamin D is altered by the different manner of development of these teeth. In animals placed on deficient diets when mature, the characteristic changes occur only in relatively slight degree, even though the animal is subjected to the strain of pregnancy and lactation, such that the incisors and bone show marked alterations. This fact may depend on the decreased rate of formation of the molar dentin in the adult animal, and perhaps on the corresponding decrease in general metabolic activity of the pulp as age advances. The evidence available does not suggest that the preformed dentin undergoes decalcification from within when the animal is subjected to a severe calcium deficiency. The molar enamel, furthermore, is not structurally altered by a deficiency of calcium and vitamin D initiated after the formation of the enamel is complete. Even when the animal is born and reared on the deficient diet, it is difficult to demonstrate molar enamel changes. Gross hypoplasia, such as occurs readily in the incisors, has not been seen in the molars under even the most severe conditions. In such cases, the only changes apparent are slight irregularities of contour, and the apparent reduction in breadth at the contact surfaces.

When vitamin D is added to the low calcium diet in amount sufficient to produce normally calcified bone, the teeth may continue to show defects, particularly when these conditions operate over a prolonged period. In this case, the changes in the incisors differ only in degree from those that develop on diets deficient in vitamin D as well as calcium. The molars, on the other hand, show a different pathologic picture when the diet contains vitamin D, resembling that produced by low phosphorus diets. Dentinoid, instead of occurring uniformly on the pulpal surface of the dentin, is in this instance produced locally in excess, and elsewhere slightly or not at all. The pulpal floor and the roots, especially the apical regions of the latter, show the broadest dentinoid formations. Frequently, the surface of the dentinoid is thrown into irregular folds and lacunae, and the odontoblasts bordering on these irregular regions become disarranged and distorted. When these conditions operate continuously through prenatal and postnatal life, this distortion may involve the entire wall of the tooth and produce an effect which suggests the crumpling of a softened mass. In the presence of vitamin D, the low calcium diet does not generally produce appreciable changes in the enamel, either in the incisors or in the molars.

THE PRODUCTION OF EXPERIMENTAL CARIES IN RATS

The unsuccessful attempts to produce dental caries in rats described in the foregoing sections suggested that the means employed were not in themselves sufficient to accomplish this purpose, and consequently that previous workers, whose findings had formed the basis of these studies, must have overlooked an essential causative factor in their findings. A critical reexamination of the literature made at this time[4] indicated that the lesions described by other workers could be grouped into two general classes. In the first class,[5] the lesions were reported to occur predominantly or only in adult or old animals, and they seemed to begin in the normally exposed dentin at the molar cusp summit. Such a lesion did not seem comparable to the most prevalent variety of dental caries in man, which begins in enamel, in regions not subject to attrition, and occurs chiefly in young persons. Most of the lesions described in the literature which did not fall clearly into this class of cusp-summit lesions could be assigned to it for the lack of convincing evidence to the contrary. The evidence contained in two additional reports, on the other hand, suggested that a lesion of a different type, apparently analogous to enamel caries in young human beings, could be produced in rats. Shibata[6] recorded the production of a lesion of the fissures of rat molars, occurring at an early age. Barker,[7] in a paper on the histopathology of dental caries in general, included a photomicrograph of apparently characteristic enamel fissure caries in a rat molar, unfortunately without useful supplementary text. Shibata's results had been obtained by feeding a diet inadequately described as consisting of "whole rice and greens," plus from 5 to 10 per cent of various carbohydrates. Believing that the mere presence of the carbohydrate was the essential factor in the production of this lesion, which he assumed resulted from the mechanism postulated by the Miller theory, Shibata[8] did not carry his experiments beyond the production of the lesion. His work seemed to provide a means for producing typical dental caries in rats. A group of rats was therefore placed on a diet composed as nearly as possible according to Shibata's directions, consisting of unground brown rice, 92 per cent, white potato dextrin, 8 per cent, plus 5 gm. of fresh spinach leaves per rat per day. (At the same time, a request for more detailed information was sent to Professor Shibata by radio, through the courtesy of the American Radio Relay League. A detailed reply was received after the first results in this work were obtained, and included photomicrographs, stained decalcified sections, dried jaws and a sample of the rice used. A study of all of this material left no doubt that Shibata had observed true caries, apparently in addition to other lesions, and that the manner in which these lesions were produced was the same as that here described.) This experiment resulted in the production of typical dental fissure caries lesions, and thus led directly into studies aimed to disclose the factors in the etiology of the lesion. These experiments are described below.

4. Rosebury, Theodor: J. D. Res., 12:255 (April) 1932.

5. Footnote 2, references a, d and e. Klein, Henry, and Shelling, D. H.: J. D. Res., 11: 151 (Feb.) 1931. Klein, Henry, and McCollum, E. V.: J. D. Res., 11:745 (Oct.) 1931; 12:528 (June) 1932; 13:69 (Feb.) 1933.

6. Rosebury, Theodor: Star note, references c and d.

7. Barker, F. J.: Importance of Normal and Abnormal Tooth Structure, J.A.D.A., 18:17 (Jan.) 1931.

8. Shibata, M.: J. Nippon D. A., 23:214, 1930; Trans. 1st Gen. Conf. Nippon D. A., 1930, p. 123.

PATHOLOGY AND DIFFERENTIAL CRITERIA OF EXPERIMENTAL DENTAL FISSURE CARIES IN RATS

The experiments described in the following sections have made it possible to produce, virtually at will, a lesion of the fissures of rat molars which appears to be identical with fissure caries as it occurs in the teeth of young human beings. At the same time, other dental lesions, not similar to dental caries in man, have also been produced, and a distinction can now be drawn clearly between these various dental lesions in rats. Before consideration of the conditions that underly the production of these lesions, therefore, a description of their pathology and differential features may be given. The description also embodies a rating scale for the evaluation of these lesions as they occur on different experimental diets, which facilitates recording the relative size as well as number of these lesions in a roughly quantitative manner.

The description that follows may be clarified by a consideration of the morphology of rat molars as compared with that of human molars. The general similarity of tissue relationships in the molars of the two species is modified by three differences: 1. Whereas the crown of the human molar is completely covered by a layer of enamel, in rats the flattened summit of each cusp, which is the masticating surface proper, consists of exposed dentin with enamel only at the edges. It has been noted above that this is a characteristic feature of the rat molar, formed as such during the development of the tooth, and not produced merely as a result of wear after eruption. This cuspal dentin is the site of destructive lesions of rat teeth, which thus occur in a region that has no homolog in human teeth. 2. The fissures or grooves in the rat molar are lined throughout with enamel, as in human teeth; but, in rats, they appear to be relatively deeper and wider than in man. Actually, these size relations are similar in the two species: the rat fissures average about 0.2 mm. in width, and the fissures of human teeth, although probably more variable than in rats, may frequently have a similar width. The fissures of rat teeth represent entirely normal structures; in man, fissures that are relatively deep and wide are generally regarded as developmental defects, resulting from incomplete coalescence of the cuspal lobes, each of which has its own segment of enamel organ at the inception of enamel formation. (Since this was written, Kronfeld has presented evidence that the fissures of human teeth are normal structures rather than developmental defects.) In both rat and man, these fissures are favorable sites for the retention of food, and for the development of dental caries. 3. Human teeth approximate at points of contact, typically situated near the occlusal plane, but far enough from it to form an angle similar to a fissure of the crown itself. In man, these interproximal sites are also favorable for the retention of food and the development of caries. In rats, on the other hand, the molars approximate over a surface which extends to the occlusal level. Food impaction is unusual in this location, and caries perhaps for this reason rarely occurs here.

Ten stages of fissure caries in rats have been defined as described below. By applying a number to each stage and recording the incidence of fissure caries by the corresponding number, average values may be derived for lesions in a given tooth in each experimental group, and index values for each group as a whole. Both of these values are useful comparatively. The first value ("average lesion") is obtained by dividing the sum of the values for the given tooth (e.g., third molar) by the number of affected teeth

in the group. The second value ("index") is obtained by dividing the total score for the group by the number of animals in the group. The individual stages of fissure caries, defined by examination of decalcified sections, are as follows, the corresponding stage numbers being those given in parentheses: (1) Caries of the enamel only, definitely centered at the base of the fissure, appears either as a generalized accentuation of the organic structure of the enamel (diffuse penetration) or as a darkening of one or more lamellae which happen to occur in the path of the lesion (lamellar penetration). Occasionally the two types of penetration in enamel may occur together. (2) The process has reached the junction of the enamel and the dentin, and spread slightly along this junction in the form of a densely blue (hematoxylin) stained deposit, but without penetrating the dentinal tubules. (3) and (4) are similar to (2) except that the extent of dentino-enamel spread is moderate in (3) and extensive in (4). (5) The blue stained deposit has penetrated into the dentinal tubules and begun to approach the pulp; the tubules have become widened and accentuated, and show typical "liquefaction foci" as in caries of dentin in man. In this stage, either the lateral spread at the dentino-enamel junction or the degree of penetration is slight, or both are slight. (6) and (7) are similar to (5) except that (6) is a lesion of moderate size and (7) an extensive lesion. In the last, the pulp may or may not be infected and show an inflammatory reaction, this depending on the relative thickness of the dentin wall. (8) The process has proceeded with loss of surface continuity and formation of a cavity. In this stage, although cavitation is present, the lesion otherwise is small. (9) and (10) are similar to (8) except that (9) is of moderate size and (10) extensive. In the last stage, only lesions which are clearly centered under a fissure, with part or all of the cusps on both sides still standing, are classed as fissure caries. All other gross lesions, for the reasons given below, are classified as "cusp-fracture" lesions.

Similar stages have also been defined in the development of a distinct type of rat lesion, to which the name "cusp-fracture" lesion has been applied because of its manner of origin. In the first stage in the formation of this lesion (stage I), fracture occurs through the dentin, sometimes also through the enamel, of the molar cusp. In this stage, the pulp may or may not be exposed to contamination from the mouth, and consequently show an acute inflammatory response; but no "carious" changes are present. In the further development of this lesion (stage II), changes apparently identical with those of true caries of dentin develop as a secondary phenomenon, and, perhaps with the help of continued fracture, accomplish the loss of cuspal tissue. In this stage, the lesion definitely affects the cusp primarily, the neighboring fissures showing little or no involvement; and the pulp is generally abscessed or necrotic. The lesion progresses farther to form a widely open cavity (stage III), readily apparent macroscopically, but still clearly centered under a cusp. In the last stage (stage IV), the lesion has progressed still further, even to complete destruction of the crown, so that determination of the manner of origin has become impossible. Since with few exceptions the gross lesions observed in this work which have been identifiable were clearly of the cusp fracture type, all gross lesions other than those with the characteristics of stage 10 fissure caries, as described above, have been classed in the record as stage IV fracture lesions. Fracture lesions occur most commonly in the posterior portion of the lower first molar, and are trace-

able to fracture of the large subdistal cusp of that tooth. They occur less commonly in other locations.

ETIOLOGY OF EXPERIMENTAL DENTAL FISSURE CARIES

1. *Cereal Particle Size.*—Following the successful production of fissure caries in rats, the demonstration of the histopathologic character of the lesion and its differentiation from other lesions, experiments were immediately set up to determine the conditions responsible for the lesion. Certain striking facts have come out of this study and, up to the present, a considerable body of useful information on the subject has been accumulated; but the field has shown itself to be complex, as might have been predicted from a knowledge of the human problem, and its complete solution is still a matter for further study. The most striking direct factor in the etiology of these lesions involves the particle size of cereal in the experimental diet. Fissure caries has been produced in rats in these experiments only by means of diets containing relatively large particles of uncooked cereal, and has been prevented outright by the use of entirely comparable diets in which the cereal was cooked or very finely ground. In the first experiment in which this fact was disclosed, the basal diet employed, a slight modification of that given previously, consisted of brown rice, 90 per cent; dextrin, 5 per cent; maltose, 5 per cent, and fresh spinach leaves, 3 gm. per rat a day. Four groups of rats were placed on this diet with, respectively, unground rice, rice ground so that the entire product passed a sieve with ten holes to the linear inch (hereafter called 10 mesh rice), rice ground similarly to pass a 20 mesh sieve and rice thoroughly cooked in a double boiler for one hour. These animals were maintained on the diets for periods ranging from twenty-four to 102 days, then killed and their jaws sectioned and examined microscopically. Of eight animals on the unground rice diet, all developed caries, and 67 per cent of the teeth examined were affected. On the 10 mesh rice-diet, likewise, all of the nine animals developed caries, and 70 per cent of their teeth were affected. On the 20 mesh rice-diet, only three of nine animals were affected, 26 per cent of the teeth examined being carious. None of eleven animals on the cooked rice diet showed caries. The 20 mesh-rice had been the finest product which could be ground in the laboratory mill. To test this finding more conclusively, a batch of the same brown rice was ground at a milling factory so that the entire product passed a 100-mesh sieve, forming a nearly impalpable flour. Two additional groups were then placed on the original rice-8 per cent dextrin diet, one group receiving 10-mesh rice, the other, 100-mesh rice. Of the former group, all of the four animals showed caries, involving 58 per cent of the teeth examined. Of five animals on the 100-mesh rice-diet, none showed caries. Additional confirmation of this striking effect of the physical character of the diet was obtained in the experiment with adequate diets described below.

2. *Influence of Cereal Particle and Added Carbohydrate.*—An additional experiment demonstrated that corn may be substituted for rice in the caries-producing diet with at least equal effect, and that dextrose or sucrose may similarly be substituted for dextrin. This experiment disclosed further that the cereal particle itself is the essential caries-producing ingredient of these diets, since it was found to be possible to produce caries with a coarse rice diet in the absence of added carbohydrate. The diets employed consisted of (1) corn (ground from whole yellow kernels to pass a 10-mesh sieve), 92 per cent; dextrin, 8; (2) 10 mesh rice,

92 per cent; dextrose, 8; (3) 10 mesh rice, 92 per cent; sucrose, 8, and (4) 10 mesh rice, 100 per cent. In each case, 3 gm. of spinach leaves was given each rat every day. The incidence of caries was 100 per cent in the first three groups (five animals in each), and 75 per cent in the last (three of four animals).

3. *Influence of Dietary Deficiency.*—The original rice-dextrin diet employed is deficient in protein, vitamin D and minerals, especially calcium. These deficiencies were reflected in poor growth and defective structure. The teeth displayed the characteristic effects of calcium-vitamin D deficiency previously observed as a result of "synthetic" low calcium, low vitamin D diets. The same defects were shown not only by the animals that received diets containing coarse cereal particles, most of which developed fissure caries, but also by the animals on the cooked-rice and 100-mesh rice diets, none of which showed caries. This fact, as well as the previous negative findings with diets having a similar nutritional character, suggested that the deficiency could not be the determining factor in the production of these lesions. It was necessary to determine whether the dietary deficiency played any part in the production of the lesions. In the first experiment set up for this purpose, it was found that the use of a diet containing 10-mesh rice, but with all the deficiencies of the previous diets fully corrected, did not prevent the occurrence of fissure caries. Such adequate diets did induce a reduction in the incidence of caries, as compared with the deficient diets. In view of the emphasis placed, in numerous quarters, on the importance of dietary deficiencies in caries, both in man and in experimental animals, we have studied at some length the difference thus observed between deficient diets and adequate diets in their capacity for producing caries in rats. The results obtained thus far are here grouped for convenience under two heads: (1) the comparative effects of deficient diets and adequate diets in general, and (2) an attempt to determine the factor in the adequate diets responsible for the difference observed.

TABLE 2.—EFFECT ON THE INCIDENCE OF FISSURE CARIES OF THE ADDITION OF CALCIUM, PHOSPHORUS AND COD LIVER OIL TO THE DEFICIENT CARIES-PRODUCING DIET

Diet	Additions to Basal Diet	Number of Animals	Experimental Period Days	First Caries Days	Fissure Caries				Average Lesion*			Index*
					Animals		Teeth					
					Number	Per Cent	Number	Per Cent	1 m.	2 m.	3 m.	
24	None	7	48–154	48	5	71	10	48	1.6	4.3	2.0	3.4
25	Cod liver oil	7	48–154	134	1	14	1	5	3.0	...	...	0.4
26	Ca:P = 1.43	7	48–154	93	5	71	11	52	5.6	3.3	5.0	6.9
27	Ca,P,cod liver oil	6	49–154	69	3	50	3	17	2.0	2.0	6.0	1.7
28	Ca,P,cod liver oil, protein	6	48–154	154	1	17	1	6	9.0	...	...	1.5
37	Ca, P, 2% cod liver oil	7	49–100	49	3	45	5	24	3.3	2.5	...	2.1
38	Ca, P, 5% cod liver oil	7	49–100	..	0	..	0	..	...	...	...	0
39	Ca, P (traces)	5	49–100	49	5	100	9	60	2.5	2.5	7.0	7.2

*See footnote, Table 1.

COMPARATIVE EFFECTS OF DEFICIENT DIETS AND ADEQUATE DIETS ON FISSURE CARIES IN RATS

Table 1 presents the pooled results obtained in the course of these studies with 123 animals placed on slight variations of the two types of diets under consideration: the deficient diets, consisting of unground, or 10-mesh, rice, 90-92 per cent; dextrin, dextrose, or sucrose, 8, or dextrin, 5, plus maltose, 5; and the adequate diets, consisting of 10 mesh rice, 66-76 per cent; dextrin, 4-8; maltose, 0-8; wheat gluten, 10; egg albumin, 0-8; Osborne-Mendel salt mixture (No. IV), 4; calcium lactate (diet 16 only), 2; cod liver oil, 2; yeast powder 0.4 gm. per rat a day (in two diets only). All diets were supplemented with 3 or 5 gm. of spinach per rat a day. Table 1 does not record the fact that the results obtained with the several deficient diets were markedly consistent, so that the individual index values varied little from the average. The variation among the adequate diet groups was somewhat greater. An analysis of these data reveals the following: 1. Fissure caries may be produced in rats by means of diets which are adequate in all nutritional respects. The animals in these groups, whether caries occurred in their teeth or not, grew normally, appeared entirely healthy and showed normally developed and calcified teeth. Hence, as a corollary, it may be stated that fissure caries in rats is not incompatible with normal health and normal dental structure. 2. The difference in incidence of caries on the two types of diets may be interpreted as an effect of retardation produced by the adequate diets. It will be noted that, although animals were killed at about equally early ages in the two groups, the first lesion of fissure caries appeared consistently earlier in the deficient diet groups than in the adequate diet groups. Furthermore, in the single group (diet 16) which had re-

TABLE 3.—DATA ON CALCIFICATION, BLOOD LEVELS OF CALCIUM AND PHOSPHORUS AND BONE ASH ON VARIOUS DIETS

Diet	Calcification		Blood		Bone Ash* Per Cent
	Teeth	Bone	Calcium Mg. per 100 c.c.	Phosphorus Mg. per 100 c.c.	
24—Basal deficient	Very poor	Very poor	5.96 ±*0.26	7.24 ± 0.91	39.7 ± 2.9
25—Bas. def.+ cod liver oil	Poor-normal	Normal	10.05 ± 1.31	7.10 ± 0.94	46.1 ± 2.9
26—24 + Ca,P	Normal	Normal	10.56 ± 0.48	6.64 ± 1.39	60.5 ± 1.7
27—24 + Ca,P, 2% cod liver oil	Normal	Normal	10.59 ± 0.13	7.39 ± 1.73	61.9 ± 2.7
28—27 + protein	Normal	Normal	10.84 ± 0.23	8.25 ± 0.65	61.6 ± 3.1
37—24 + Ca,P,2% cod liver oil	Normal	Normal	10.54 ± 0.09	7.72 ± 0.45	61.7 ± 0.8
38—24 + Ca,P,5% cod liver oil	Normal	Normal	10.36 ± 0.17	7.17 ± 0.83	61.1 ± 1.6
39—24 + Ca,P (traces)	Normal—Rather poor	Normal—Rather poor	7.95 ± 1.69	7.58 ± 0.79	56.5 ± 1.5
16—adequate,caries+	Normal	Normal	10.38 ± 0.30	6.60 ± 0.73	64.4 ± 0.2
Stock-adequate,caries-	Normal	Normal	10.15 ± 0.30	7.12 ± 0.33	.....

*Values are average deviations.

ceived an adequate diet for an extended period (319 days), the final incidence of caries became equal to that obtained with the deficient diets in a shorter period.

Litter mates of animals on diet 16 were placed on a diet identical in composition except that 100-mesh rice was substituted for 10-mesh rice. These animals were maintained on the diet for a similar period, but failed to show caries, other than a single small (stage 1) lesion, which may have been an artefact. The effect of particle size of rice was thus confirmed for the adequate diets.

THE INFLUENCE OF CALCIUM, PHOSPHORUS AND VITAMIN D ON FISSURE CARIES IN RATS

The adequate caries-producing diets differed from the deficient diets in a number of respects. Any one or any combination of these differences might be responsible for the retarding effect of the adequate diets; but the most likely factor appeared to be the superior calcifying properties of the adequate diets. The attempt was made analytically to determine the essential ingredient in this mechanism. The 10-mesh rice-8 per cent dextrin diet was used as a basal control. Animals were then placed on groups receiving, respectively, the following additions to this diet: (1) 2 per cent cod liver oil (diet 25); (2) calcium and phosphorus to adequate levels and a ratio of calcium:phosphorus of 1.43 (diet 26); (3) calcium and phosphorus as in the preceding, plus 2 per cent of cod liver oil (diet 27); (4) all the foregoing additions, plus 7 per cent of protein (wheat gluten) (diet 28); (5) calcium as in diet 26, but a higher level of phosphorus, to produce a ratio of 1.03, plus 2 per cent of cod liver oil (diet 37); (6) the same as the preceding, but with 5 per cent of cod liver oil (diet 38); (7) the basal deficient diet with traces of calcium and phosphorus added, as a check on the variations in rice obtained in different batches. Diets 26-28 contained amounts and ratios of calcium and phosphorus near the accepted optimum for the rat; diets 37 and 38 contained additional phosphorus, an effort being made to induce a high blood-phosphorus level. The results of these experiments are summarized in Tables 2 and 3. Caries occurred in all but one group, that on diet 38; but in the remaining groups which received adequate calcium and phosphorus, or vitamin D, or both, the retarding effect observed with generally adequate diets was again obtained. The absence of caries on diet 38 might suggest that 5 per cent cod liver oil is a preventive of experimental caries, but the group was small and the result might have been an effect of chance variation. The control group in this instance showed an exceptionally low incidence of caries, a result which seems traceable only to chance. The results as a whole indicate that some part or combination of the calcium-phosphorus-vitamin D complex in the diet is the factor responsible for the observed retardation of caries, but further study is required to define this factor more exactly.

The attempt to correlate the incidence of caries with calcification of the teeth and bones, summarized in Table 3, fails to reveal any consistent relationship. The basal deficient caries-producing diet (diet 24) produces very poor calcification of teeth and bone, a low blood calcium level, and a low percentage of ash in the bones, with, ordinarily, active and rapid caries. But the addition, in diet 39, of traces of calcium and phosphorus resulted in individual instances in normal calcification, normal blood values and normal bone ash without a reduction or retardation of caries. This was probably due to the ready assimilability of the added salts. Conversely, the simple addition of 2 per

cent of cod liver oil to the basal diet (diet 25) did not, in all cases, effect normal calcification or bring the blood calcium and ash values to normal. Yet only one animal in this group showed caries. A comparison of the results in the remaining groups fails to reveal an explanation of the observed variations in the incidence of caries. The result obtained with diet 38, for example, is not reflected in distinctive blood or ash values, nor do these values appear to explain the relatively high incidence of caries with diet 26. Thus, the results generally point to some phase of the calcium-phosphorus-vitamin D complex in the diet as the factor responsible for the retardation of fissure caries. Nevertheless, although it would seem reasonable to assume that such a factor operates by way of the mechanism of calcification, these results do not support such a view; nor do they reveal an alternative mechanism for the action of this factor. Further study is necessary on this point.

THE ETIOLOGY OF CUSP-FRACTURE LESIONS

In this work the major emphasis has been placed on fissure caries, for obvious reasons; but the incidence of fracture lesions has also been recorded in the same experimental groups, and these may here be summarized briefly. Table 4 shows the distribution of these lesions, as observed microscopically in three lower molars of each animal. On one point, the etiology of these lesions is similar to that of fissure caries: they occurred only in groups receiving diets which contained coarse cereal particles, and were prevented when the cereal particle was cooked or very finely ground. Fracture lesions did not occur on the fully adequate diets, which did produce fissure caries. These results were interpreted as indicating that well calcified teeth were made resistant to fracture by this means. This was not confirmed by the results subsequently obtained with diets 25 to 38, on which fracture lesions occurred as freely as on the more deficient diets. It may be noted in passing that diet 38, with which no fissure caries was obtained, did produce fracture lesions. The explanation of these findings is not clear. Presumably, fracture lesions develop as a result of the impact of coarse particles on the molar cusps during mastication. The structure of the teeth should be important as a factor of susceptibility in such a process. If this is true, it may be that the structure of the teeth is affected significantly by one or more of the factors of difference between the fully adequate diets as a group and all the remaining coarse particle diets listed in Table 4. These factors are salts other than calcium and phosphorus, contained in the Osborne-Mendel salt mixture, and protein, which was present in the adequate diets in higher concentration than in the others. This suggests an interesting lead for further study.

RELATIONSHIP OF THESE FINDINGS TO THOSE OF OTHER INVESTIGATORS

An extended review of the literature on experimental lesions in rats is included in the fourth paper of this series.[9] Such a review is beyond the scope of the present report, but a brief summary of the comparative status of the studies herein reported may profitably be included. In recent years, the subject has awakened active interest in numerous quarters, so that a considerable literature has developed rapidly. The reports of Shibata[10] and Barker[7] which have been mentioned contained jointly the clear indication that typical dental caries may be produced in the rat. Other reports which have ap-

9. Rosebury, Theodor; Karshan, Maxwell, and Foley, Genevieve: Star note, reference e.
10. Shibata, M.: Footnote 2, reference f.

peared up to this time (January, 1934)[11] are subject to one or both of two criticisms, which may help to explain the contradictory character of the literature: (*a*) the lesion under consideration is of doubtful character, or clearly involves the molar cusp primarily, or seems to embrace indiscriminately, lesions of several types; (*b*) the diets employed contained cereal particles (generally corn) the size of which had not been determined, and possible importance of which as a factor in the result obtained was overlooked or disregarded. Among these reports that of Hoppert, Webber and Canniff[12] is notable in that these workers were the first to demonstrate the importance of cereal particle size in the production of dental lesions generally, although the character of the lesions which they produced has not been satisfactorily defined. An exception to the foregoing rule is a recent brief report by Arnim, Clarke, Anderson and Smith,[13] in which typical early fissure caries was produced and distinguished from cusp lesions, in experiments involving the use of diets which apparently did not contain coarse particles. An attempt is being made to repeat these experiments in this laboratory.

RELATIONSHIP OF EXPERIMENTAL CARIES IN RATS TO DENTAL CARIES IN MAN

It is not possible at this time to define exactly the degree to which the results of the investigations recorded herein are or will be applicable to the problem of dental caries in man. At present, it is hardly likely that they can be transferred bodily from the experimental to the clinical field, if only because of the fact that the human dietary is never known to contain coarse uncooked cereal particles. That these findings in rats may nevertheless embody the same principles that underly the human disease is indicated by the following three items of evidence: 1. Fissure caries in rats appears to be identical histologically to fissure caries as it occurs in the teeth of young human beings. The pathology of dental caries is not completely understood, but such comparison as can be made on the basis of available knowledge indicates this striking similarity, and fails to reveal any distinctions which can be regarded as damaging to this point of view. 2. The direct factors disclosed thus far in the etiology of fissure caries in rats are not in essential disharmony with the established facts relating to dental caries in man. In both species, the disease appears to result from conditions which are a part of the environment of the mouth. In the human disease, the Miller theory, although it is admittedly incomplete, still has no serious competitor as an explanation of the

11. Bunting, R. W.: Footnote 2, reference a. Grieves, C. J.: Footnote 2, reference b. McCollum, E. V., et al.: Footnote 2, reference c. Macomber, Donald: Footnote 2, reference d. Marshall, J. A.: Footnote 2, reference e. Klein, Henry, and Shelling, D. H.: Footnote 5, second reference; Klein, Henry, and McCollum, E. V.: Footnote 5, third reference. Kronfeld, Rudolf, and Barker, F. J.: Experimental Study of Influence of Vitamin D on Hard Tissues of White Rats, J.A.D.A., 19:105 (Jan.) 1932. Hoppert, C. A.; Webber, P. A., and Canniff, T. L.: Science, 74:77, 1931; J. D. Res., 12:161 (Feb.) 1932. Kellogg, M., and Eddy, W. H.: D. Cosmos, 74:334 (April) 1932. Bödecker, C. F., and Applebaum, Edmund: D. Cosmos, 74:335 (April) 1932. Blackberg, S. B., and Berke, J. D.: J. D. Res., 12: 349 (April), 609 (Aug.) 1932. Agnew, Mary C.; Agnew, R. G., and Tisdall, F. F.: J. D. Res., 12:449 (June) 1932; Production and Prevention of Dental Caries, J.A.D.A., 20: 193 (Feb.) 1933. Templin, V. H., and Steenbock, Harry: J. Biol. Chem., 100:217 (March) 1933. Whittle, H. L.; Klein, Henry, and McCollum, E. V.: J. D. Res., 13:189 (June) 1933. Shelling, D. H., and Asher, D. E.: J. D. Res., 13:363 (Oct.) 1933.

12. Hoppert, C. A.; Webber, P. A., and Canniff, T. L.: Footnote 11, tenth reference.

13. Armin, S. S., et al.: J. Biol. Chem., 100: viii, 1933.

mechanism of the process. In rats, the same explanation is equally satisfactory and equally incomplete. Experimentally, we may postulate a mechanism of forcible impaction of large fermentable particles into the fissures of the molars as an essential part of this mechanism. The possibility that a similar or related mechanism may be important in man remains open.

3. The indirect factors in the etiology of fissure caries in rats appear to correspond with similar factors in the human disease disclosed relatively recently. In rats, some phase of the calcium-phosphorus-vitamin D complex in the diet appears to exercise a retarding influence on the development of fissure caries. The studies of Mellanby,[14] Boyd and Drain,[15] Bunting,[16] McBeath,[17] Schoenthal and Brodsky[18] and others have made it clear that an apparently similar effect is exerted on the development of caries in children when the diet is fortified with the so-called protective foods, and these findings are generally interpreted as indicating the influence of some phase of the calcifying complex in the diet. In rats, the character of the effective ingredient or combination cannot yet be discerned, and the mechanism by which it acts remains obscure. These facts are no less true in the case of dental caries in man.

The foregoing evidence thus seems amply to warrant a working assumption of the relationship of experimental caries in rats, as described in this report, to the problem of dental caries in man. The experimental study is still incomplete, but the comparative ease with which the experimental lesion may be produced, and the generally ready availability of the materials necessary for further study, make additional work along these lines highly desirable. Such additional studies are in progress.

TABLE 4.—INCIDENCE OF FRACTURE LESIONS ON VARIOUS DIETS

Diet	Number of Animals	Fracture Lesions		
		Animals	Per Cent	Average Lesion
11 deficient diet groups, whole or 10 mesh rice	82	40	49	2.3
10-mesh corn-dextrin, deficient	5	2	40	2.0
Cooked rice-dextrin-maltose, deficient	11	0	..	...
100-mesh rice-dextrin, deficient	5	0	..	...
6 adequate diet groups, 10-mesh rice	41	0	..	...
100-mesh rice, adequate	9	0	..	...
25, basal deficient + 2% cod liver oil	7	0	..	...
26, basal deficient + Ca, P	7	2	29	2.0
27, basal deficient + Ca, P, 2% cod liver oil	6	3	50	1.3
28, basal deficient + Ca, P, 2% cod liver oil, protein	6	1	17	1.0
37, basal deficient + Ca, P, 2% cod liver oil	7	4	57	2.8
38, basal deficient + Ca, P, 5% cod liver oil	7	2	29	2.0

14. Mellanby, May: Brit. M. J., 2:749 (Oct. 27) 1932.

15. Boyd, J. D., and Drain, C. L.: J.A.M.A., 90:1867 (June 9) 1928.

16. Bunting, R. W.: J. D. Res., 9:291 (June) 1929. Bunting, R. W.; Delves, Edna, and Hard, Dorothy G.: J. D. Res., 10:374 (June) 1930. Bunting, R. W.; Jay, Philip, and Hard, Dorothy G.: J. D. Res., 12:444 (June) 1932.

17. McBeath, E. C.: J. D. Res., 12:723 (Oct.) 1932; 13:243 (Oct.) 1933.

18. Schoenthal, L., and Brodsky, R. H.: Am. J. Dis. Child., 46:91 (July) 1933.

DIET AND DENTAL CARIES*

By RUSSELL W. BUNTING, D.D.Sc., Ann Arbor, Mich.

AT the present time, in the study of dental caries, all eyes are being focused on the influence of diet as a causative or controlling factor in this dental disease. The literature abounds in contributions to the subject, and many dietary studies and surveys related to dental caries are being reported. Out of the confusing mass of data and reported findings, many different viewpoints and often diametrically opposed conclusions have come. In fact, it is very difficult to find any common agreement or established facts.

In a critical analysis of these reports, it will be found that many of the studies have not been scientifically organized, nor have the experiments been adequately controlled. Moreover, in many instances, the conclusions drawn by the investigators have not been supported by the findings published in their reports. Consequently, there is considerable confusion of thought in regard to the way in which diet influences dental caries and, at the present time, there are very few findings on the problem which may be said to be definitely established and generally accepted as facts.

In the study of dental caries, there are two schools of thought. The first group holds the view that the most important consideration in the determination of the disease is the environment of the tooth; that is, the bacterial flora, the carbohydrates, the acids which are formed and the films or plaques which protect the acids of caries from dilution and neutralization. The second is composed of those who believe that the perfection and resistance of the tooth itself to the attacking force is most important. They believe that the control of dental caries can be attained only by the building of resistant dental structures. Both groups agree that dental caries is very closely associated with diet and that, at the present time, the most efficient known preventive measures against dental disease are those of dietary regulation.

RACIAL DISTRIBUTION OF DENTAL CARIES

Perhaps the most outstanding observations of diet and dental caries have been the reports of a very low incidence of this disease among native people who live quite apart from modern civilization. The natives of Alaska, Newfoundland, South America, the South Sea Islands, Africa, the interior of Europe and Asia who live wholly on food indigenous to their locality are, as a rule, almost wholly free from dental caries; but whenever these people adopt the refined, stored and artificially prepared foods of civilization, dental disease almost invariably

*From the School of Dentistry, University of Michigan.

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

follows and often becomes highly virulent. The Island of Pitcairn has been cited as one of the few places in the world where this rule does not obtain. Here, caries of the anterior teeth especially is very prevalent. The diet of these people is not adequate nutritionally. They have no milk and little meat other than fish. Furthermore, their chief food products are sweet potato and sugar cane. From the latter, they express a sweet syrup which they consume in large quantities.

The question then arises as to what important differences exist between the native and the modern foods which affect the incidence of dental caries. Is it the absence or deficiency of some essential food factor? Is it the presence of some harmful principle, or is it some disproportion of food elements which causes the modern diet to favor the development of caries of the teeth so markedly?

ANIMAL EXPERIMENTATION

The answer to this question was first sought in animal experimentation. By feeding guinea-pigs a scorbutic diet, Howe produced experimental caries in the animal, and later the phenomenon was observed by others in different types of animals by feeding a variety of forms of deficient diets. These observations led to much speculation and many hypotheses relative to diet and dental caries, but practically all passed into the discard when it was demonstrated by Hoppert and Webber[1] that the fineness of division of foods was more important in the production of dental caries in rats than the quality of the diet. They produced caries in the teeth of rats at will by feeding coarsely ground adequate diets. The same diets produced no caries when finely ground. These findings, which have been corroborated by others, have negated practically all previous animal experimentation in which the fineness of food was not taken into consideration, and has clearly shown the fallacy of many conclusions drawn from such experimentation.

HUMAN EXPERIMENTATION

A more promising field of study has been that of human dietary experimentation. Groups of children have been fed on a variety of diets and the clinical conditions have been recorded to determine the effect on the activity of dental caries. Among the earliest studies are the experimentations of May Mellanby, of England. She fed children diets highly fortified with cod liver oil or vitamin D concentrates, and reported a marked decrease of dental caries. She believes that vitamin D is the most important protective, and that the addition of cereals to the diet favors dental caries by increasing the need for vitamin D.

Howe has consistently maintained that vitamin C is the most important protective. In a recent report[2] on the feeding of children, he states that dental caries is retarded by the use of a fortified diet in which vitamin C is high and the cereal intake low. As this diet contained many protective food principles other than vitamin C, the significance of this factor is not apparent.

Boyd and Drain[3] were first impressed with the importance of diet as regards dental caries when they observed that children fed on diabetic and celiac diets were not affected by dental disease. They

1. Hoppert, C. A.; Webber, P. A., and Caniff, T. L.: Production of Dental Caries in Rats Fed an Adequate Diet, J. D. Res., 12:161 (Feb.) 1932.

2. Howe, P. R.; White, R. L., and Rubine, M.: Retardation of Dental Caries, Am. J. Dis. Child., 46:1045 (Nov.) 1933.

3. Boyd, J. D. and Drain, C. L.: Arrest of Dental Caries in Childhood, J.A.M.A., 90: 1867 (June 9) 1928.

later carried the principle of adequate nutrition to normal children and found that they also showed marked arrest of dental caries. They place no special emphasis on any one food factor, but believe that through the feeding of a well-balanced ration, adequate food materials are furnished which so strengthen the teeth that they resist the forces of caries. In their opinion, bacteria of caries are omnipresent and purely incidental in the process, and the perfection of organization of the tooth is the sole determinant factor.

Hawkins[4] has fed adequate diets well fortified with fruits and green vegetables, but low in cereals and sugar. He has reported a definite arrest of caries under this diet. He does not believe that this result is obtained through the increase of resistance of the tooth, but rather through the increase of alkaline elements in the saliva by which it can neutralize the acids of caries.

Martha Jones, in her study of caries and odontoclasia in Honolulu, agrees with Hawkins, stating that active caries is always associated with an excess of acid over basic elements in the diet.

McBeath[5] reports observations on large groups of children fed on a variety of diets and states that dental caries was markedly reduced by the feeding of adequate well-balanced rations. He is impressed with the importance of diet as a controlling factor in dental caries, but does not believe that any one food element is of more importance than another. He does stress the need for vitamin D and concurs with the view of Mrs. Mellanby in that regard.

Brodsky[6] studied the dietary habits of 600 children and found that a lack of fruit, milk or vegetable was associated with dental caries. He states that neither the calcium and phosphorus of the blood serum nor dental hypoplasia or oral hygiene bears any consistent relationship to dental caries. He believes that, if the diet is adequate, viosterol or quartz light treatments are not necessary for the control of caries.

Breese[7] observed 600 children in British orphanages and noted a very low incidence of caries (0.8 cavity a year to each child). These children were fed on a diet that was not optimal, but was low in sugar. Apples were substituted for sweet desserts. He cites the fact that in England during the war, when sweets were limited, dental caries was markedly reduced in children. He strongly objects to the theory that diet controls caries by strengthening the teeth, and states that no enamel is strong enough to resist the acids of caries. He somewhat facetiously draws a comparison with the use of hair tonics for the prevention of baldness.

MICHIGAN DIETARY STUDIES

During the past four years, investigations on the cause and control of dental caries have been carried on in the School of Dentistry of the University of Michigan. These studies have been directed along three general lines; namely, bacteriology and immunology, chemistry of the blood and saliva, and nutrition as these factors relate to the activity of dental disease. The results of these investigations have been published in full.

4. Hawkins, H.: Manipulations of Food in Control of Dental Caries and Systemic Pyorrhea, J.A.D.A., 19:963 (June) 1932.

5. McBeath, E. C.: Experiments in Dietary Control of Dental Caries in Children, J. D. Res., 12:723 (Oct.) 1932; Nutritional Control of Dental Caries in Children Over a Two Year Period, J. D. Res., 13:243 (June) 1933 (abstr.).

6. Brodsky, R. H.: Factors in Etiology and Arrest of Dental Caries, J.A.D.A., 20:1440 (Aug.) 1933.

7. Breese, F.: Diet and Teeth, Brit. D. J., 56:120 (Feb. 1) 1934.

The nutritional studies in relation to dental caries were conducted by Koehne and Morrell and were confined to three projects: (1) the dietary supervision of twenty-three children in the University Hospital, Ann Arbor, Mich.; (2) a dietary study of 169 children in an orphan asylum, and (3) a study of the food habits of nine caries-free and nine caries-susceptible public school children. These studies have been continued over periods of one to three years. The study of the hospital group[8] was made on twenty-three metabolically normal girls from 6 to 13 years of age. All of these children were placed on a basal diet that was adequate nutritionally. Some were continued on this diet throughout the period of observation. Others were given, in addition to the basal diet, 100 or more grams of sugar daily in the form of candy. Some were given the candy before and others after meals. There was considerable variation in the menus throughout the week, but each week's menus were the same. The children were afforded a freedom of choice in extra helpings of available foods. All individual food portions eaten were weighed and recorded. Neither cod liver oil nor sunlamp treatment was given. The observation periods ranged from five to eighteen months.

As reported in detail by Koehne and Morrell,[8] the intake of the various types of foods was remarkably constant for each child week by week. Any change, therefore, which occurred in the activity of caries in these children while on their respective diets could not be related to differences in intake of essential foods or food constituents, for these were constant throughout the period of observation. Balance studies[9] which were made on a selected group of children indicated that retention of calcium, phosphorus and nitrogen was unaffected by high sugar intake.

Of the fourteen children fed continuously on the basal diet, or the basal diet plus a moderate amount of sugar, nine showed evidence of arrested caries. Five continued to develop caries in spite of the adequacy of their diet. In these five cases, extra sugar was not permitted. The arrest of caries in the nine cases was associated with a disappearance or a very low count of *B. acidophilus* in the saliva; while in the five cases showing continued activity of caries, the counts remained high.

Among the thirteen children fed on the basal diet plus a high sugar content, nine had progressive and extensive caries. Seven of these also showed a marked increase in the *B. acidophilus* content of the saliva. Three of the remaining children were caries-immune. There was no apparent difference between those who ate the candy before meals and those who ate it after meals.

When a diet very low in both starch and sugar was fed to a highly susceptible person who had had a high *B. acidophilus* count for a long period of time, there was a marked reduction of those organisms, approaching or reaching the zero point within a few days.

In none of these cases was any change noted in the calcium, phosphorus or acid-neutralizing power of the saliva which could be related to the changed caries susceptibility of the individual.

8. Koehne, Martha; Bunting, R. W., and Morrell, E.: Studies in Control of Dental Caries in Children. I, Am. J. Dis. Child (to be published); Koehne, Martha, and Morrell, E.: Food Requirements of Girls Six to Thirteen Years Old, Am. J. Dis. Child., 47:548 (March) 1934.

9. Hubbell, R. B., and Koehne, Martha: Effect of Varying Levels of Sugar Intake on Nitrogen, Calcium and Phosphorus Retention of Growing Children, Am. J. Dis. Child., 47: 988 (May) 1934.

There was an 88.9 per cent correlation between the concentration of *B. acidophilus* in the saliva and the dental findings in the whole group.

In the study of the orphanage group which has been reported in detail by Koehne,[10] 169 children were observed over periods of from one to four and a half years. This group was selected for study because the children in this institution, numbering about 300, had been under observation during the past six years, and it had been found that among them there was a remarkably low degree of caries activity. From 75 to 80 per cent had no active caries during the period of observation, and only from 5 to 6 per cent had any appreciable amount of dental disease. A study of the dietary conditions of these children was, therefore, undertaken to determine whether any apparent nutritional factor could be related to the freedom from caries.

A careful analysis of the diet of these children, which had been fairly uniform throughout the period of observation, showed that it did not meet the standard requirements for adequate nutrition. It was below the minimum standard requirement for calories and was below recommended standards in calcium, phosphorus, protein and certain vitamins. It contained little milk and no butter. A small amount of meat was served daily. No oranges were available except at Christmas time, but a variety of vegetables were provided throughout the year, some of which were fed raw. Dessert consisted mostly of raw apple. Cookies were served once a week and a sweet dessert was available only on Sunday. Of the total caloric intake, from 40 to 45 per cent was in the form of starch and cereals. No candy was allowed the children at any time. Only a minimum amount of sugar was used in the sweetening of foods, and no sugar was placed on the table.

Certainly the freedom from caries which prevailed among these children could not be attributed to the adequacy of the diet; nor could it be correlated with a high carbon dioxide content of the saliva or the intake of calcium, phosphorus or vitamin D. There was an 84 per cent correlation with the *B. acidophilus* content of the saliva. No conclusions could be drawn from these studies relative to the influence of nutrition on the freedom from dental caries among these children. Only three principles were noted that might possibly have a bearing: (1) the low sugar content, (2) the uniformity and regularity of the dietary program and (3) the eating of hard fibrous raw fruit at the end of the meal.

The third nutritional study has been reported by Koehne in which an analysis was made of the food habits and dietary intake of nine caries-free and nine caries-susceptible children in the public schools. These children were selected for study as offering the most typical cases which could be obtained in the two groups.

In this study, certain distinctive differences were found in the food habits of members of the two groups. Almost without exception, the children in the caries-free group had excellent appetites and were not notional in their food selections. As a rule, their meals were regular and uniform. One could take no milk because of allergy. They ate candy and simple desserts occasionally, but had no distinct craving for sweets.

The caries-susceptible group was quite different. These children were decidedly notional in their food preferences. They ate irregularly and, in gen-

10. Koehne, Martha, and Bunting, R. W.: Studies in Control of Dental Caries. II, J. Nutrition, 7:657 (June) 1934.

eral, their diets were unsatisfactory. Three children had little milk, and two had 1 quart of milk a day. Most of the members of this group craved sweets and ate considerable quantities of candy and highly sweetened foods.

The results of the chemical studies of the blood and saliva of these children are reported by Hubbell.[12] Her results show that no consistent chemical difference could be found in either the saliva or the blood of the two types of persons. A clear correlation between the concentration of *B. acidophilus* in the saliva and caries susceptibility was shown by Hadley.[13]

In view of the many statements which are being made relative to the importance of various food elements as protectives against dental caries, the results of the nutritional studies are most interesting. The fact that dental caries was completely arrested in a large majority of persons fed over a long period on a diet that was low in calcium, phosphorus, protein, calories and certain vitamins, and also low in sugar but high in starch, does not coincide with many present-day theories regarding the dietary control of dental disease. Furthermore, the production of caries by the addition of a considerable quantity of candy to the diet of persons known to be receiving a diet that was adequate according to accepted standards is also significant. The manner in which and extent to which sugar enters into the problem of dental caries is not as yet apparent.

During the course of this study, it became evident that heredity or individual characteristics may definitely determine caries-susceptibility, irrespective of the diet. Some children who had never had caries of the teeth ate large quantities of sugar without a resultant increase in *B. acidophilus* in the mouth, or the development of dental caries. In others who were very susceptible, the disease could not be checked by the adherence to any ordinarily satisfactory diet. A diet low in both starch and sugar invariably produced a marked and rapid decrease in the number of *B. acidophilus* in the mouth. The number of children showing this inherent tendency to caries immunity or a high susceptibility was small. In the great majority, the incidence of *B. acidophilus* and dental caries was definitely changed by regulation of the diet. These inherent tendencies should be taken into account in evaluating the effect of any dietary program.

12. Hubbell, R. B.: Chemical Composition of Saliva and Blood Serum of Children in Relation to Dental Caries, Am. J. Physiol., 105:436 (Aug.) 1933.

13. Hadley, Faith P.: A Quantitative Method for Estimating Bacillus Acidophilus J. D. Res., 15:415, 1933.

SUMMARY

From the foregoing review, it will be seen that there are only a few definitely established facts concerning the relationship of diet to dental caries. Positive claims that are made relative thereto are largely unsustained either by the evidence submitted or by corroboration by others. Those who believe that dental caries is determined by the strength of the tooth do not explain why poorly formed and soft teeth frequently do not decay. Those who believe that caries is caused by a lack of vitamin D do not explain why the disease should be so prevalent in the southern lands where perpetual sunshine furnishes an abundance of vitamin D and there is no evidence of rickets. Those who assert that vitamin C is most important do not explain why the people of the tropics who have an abundance of vitamin C provided in citrous and tropical fruits may have extensive dental caries.

The observations of the Michigan

group that children on a known adequate high sugar diet had active caries, and that children on an inadequate low sugar diet had very little are significant, and indicate the need for further study before any definite conclusions can be drawn. Evidence submitted by this group indicates certain very important trends in the study of the problem, as follows:

1. In a small percentage of cases, inherited tendencies or inherent characteristics may be more important factors in caries-susceptibility than any ordinary dietary consideration.

2. In the great majority of cases, dental caries will be definitely arrested by the adoption of a simple, fairly adequate low sugar diet. The importance of the amount of sugar intake is definitely emphasized.

3. No constant relationship could be found between the degree of activity of dental caries and the amounts of calcium, phosphorus, vitamin D or C, or the acid-base values in the diet, or in the blood or saliva.

4. The only differential characteristic thus far observed between caries-free and caries-susceptible persons having a high degree of correlation is the relative number of *B. acidophilus* organisms in the mouth.

5. Diet, it seems, controls dental caries through the determination of the environment of the teeth, rather than through changes in the resistance of the tooth itself. These environmental conditions may be determined by the character and the amount of food materials retained, or by dietary metabolic influences.

DISCUSSION

Thomas J. Hill, Cleveland, Ohio: In the past few years, a vast number of investigations have been reported in the study of dental caries. I have reviewed these reports and have called attention to the conflicting results and to the differences in these reports for which no satisfactory explanation has been made. All investigators can agree that the incidence of dental caries can be influenced by diet. The main differences in the interpretation of their findings are: (1) the factor or factors in the diet responsible for the varying incidence in dental caries; (2) the manner in which diet acts to control or promote dental caries. The first one of these debatable questions cannot be answered at the present time. Reports of investigations are too conflicting and it is too early to make unqualified statements. Its answer may be more easily learned when the second of these debatable questions has been answered. What is the manner in which diet acts to control or promote dental caries? Those who have maintained that teeth may be fortified by diet against dental caries as a result of a nutrient factor available to the tooth have not produced convincing evidence of such a physiologic process. It is recognized that smooth surfaces of the teeth which come in contact with food are less liable to decay and that irregularities of the surface such as pits and grooves caused by hypoplasia contribute to the accumulation of débris and make these areas more frequently the site of caries. At the present time, there is no indisputable evidence that the incidence of dental caries is increased in hypoplastic teeth other than in those teeth which are so extremely hypoplastic that deep pits are formed. Caries once started in hypoplastic teeth may progress more rapidly, but that there is a greater instance of caries because of hypoplasia of enamel *per se* has not been shown. At the present time, to predicate that these dietary influences on dental caries are the result of a fortification of the inorganic salts in the teeth to make them more resistant to this disease is unwarranted. A hypothetical explanation of the manner in which diet influences caries has been attempted by the description of a dental lymph which passes through the dentin to the enamel and alters the nature of the content of that structure. This hypothesis is not supported by sufficient scientific evidence. From this

mass of conflicting evidence will come established facts, but it is acceptable as evidence only until the process by which diet influences caries has been explained. Is this process the result of dietary deficiencies, the influence of the calcium-phosphorus content or ratio of the blood, a change in the saliva which produces a physicochemical action on the enamel of the teeth or, as believed by Bunting, the influence that diet has on the presence of lactobacilli in the mouth? The bacterial flora of areas of caries are characterized by the presence of lactobacilli. These organisms are not only acid resisting, but acid producing. The buffer action of the saliva could be expected to neutralize locally formed acids except when they are protected by gelatinous plaques. At the present time, there is no acceptable explanation of the manner in which diet influences the incidence of caries of a nonvital substance (enamel), except for the physical tendency to increase plaque formation, or, in some ways, affect the presence and number of the lactobacilli.

Edward H. Hatton, Chicago, Ill.: Dr. Bunting's paper does not adequately emphasize the tremendous volume of research with respect to the dietary phase of caries, and its etiology and management. I have made no attempt to assemble any statistical material with reference to the amount of work that has been done as it seems wholly unnecessary to submit this statement to proof. But with this in mind, Dr. Bunting's conclusion as to the inconclusiveness of any and all of this huge dietary investigation is all the more startling. Moreover, I am compelled to accept his opinion with respect to this and to suggest further that such deductions as have been amply justified were already prevalent in the dental literature fifty years, only in a somewhat different form. For example, one may turn over the pages of the early numbers of the *Missouri Dental Journal* or the *Dental Cosmos* and find frequent references to the sophistication, refining and denaturalization of foods, separating from them vital factors necessary for adequate nutrition. These early writers were appalled by the increasing consumption of white flour, carbohydrates and refined sugar, to which they ascribe the increasing prevalence of dental decay. Less than this is included in Bunting's second conclusion. Doesn't this quite justify the belief of many that very little has been added to the knowledge of caries etiology and management since the times of Miller, Black and Williams? There is no doubt that there are human beings who are highly resistant to dental decay, as stated in Bunting's first conclusion. In contrast, it may be said that most, if not all, of the common experimental animals are even more immune. The production of decay by experimental methods in these animals must, therefore, be comparable only to the manifestation of decay in the highly resistant human being. This is a point that has been commonly overlooked. In this connection, the experimental method of Hoppert, Webber and Caniff is quite suggestive, a method which is quite adequate to break down the high refractoriness of the rat. In the human being, it probably has its application with reference to the causation of the pit and fissure type of cavity. As to the prevalence of *Bacillus acidophilus* in relationship to dental caries, I am obliged to report that Bunting's conclusions have not been generally accepted. Although I have the highest respect for the bacteriologic staff of the Michigan group, it must be admitted that other competent bacteriologists have not duplicated their results. This should not be particularly disturbing as eventually this difference of opinion will be reconciled. In order to clarify my own opinions with respect to the management of dental caries, I have tried to set up two contrasting sets of conditions one of which should produce an individual totally immune to decay and the other highly susceptible. These are a little like the hypothetical question of a lawyer, but for me are quite suggestive though quite impossible of attainment in every respect. On the other hand, such a statement does seem to introduce all the known factors in etiology and management. The differences of opinion concerning them have, after all, to do with the relative im-

portance of the different items in such a set up. I believe that a child with parents and grandparents immune to dental caries for whom there is provided reasonable home and professional care of the teeth; who consumes a high mineral, high vitamin and relatively high protein ration that requires vigorous chewing; whose cereal and carbohydrate intake especially of cane sugar and candy is low, and who ends the meal with natural fruits and fruit juices rather than puddings, cakes, pastries and highly sweetened desserts will be immune to dental caries. If this hypothetical case is reversed, I can see only one possible outcome with respect to caries.

IODINE DERMATITIS—REPORT OF CASE

By KARLTON K. PRIEST, D.D.S., San Francisco, Calif.

A SOLUTION made according to directions on a bottle of Parke-Davis' Germicidal Disks—contents as noted on bottle: three-eighths grain each of potassium iodide and mercuric iodide and 16 grains of sodium bicarbonate and renewed daily was in daily use over a period of four years for the purpose of sterilizing instruments, which were placed in the solution; then, after a suitable time, taken out and wiped before using.

Fig. 1.—Dermatitis at height of severity.

About three and one half years after I had adopted the foregoing method, a distinct dermatitis appeared on the lateral surface of my right middle finger, superficial in character and disappearing within a few days. Over a period of months, the onsets became more frequent, the inflammation more severe, until it reached the condition depicted in Figure 1. At this time, the use of the disks was discontinued with subsequent improvement, as shown in Figure 2, taken one week later. Four weeks after the first appearance of the condition shown, all signs of inflammation had entirely disappeared.

Fig. 2.—Appearance of lesion one week after discontinuance of solution.

CONCLUSIONS

Forceps were not used for removing the instruments from the solution. Though the hand was dried after the wiping of the instruments, the middle finger was slighted. Had the instruments been rinsed (and consequently, the hand holding them) under running water each time after immersion in the solution, the inflammation, in all probability would have been averted.

135 Stockton Street.

The Journal of the American Dental Association

212 East Superior St., Chicago, Ill.

C. N. JOHNSON, Editor

NEWTON G. THOMAS, Associate Editor

Published by the American Dental Association

All expressions of opinions and all statements of supposed facts are published on the authority of the writer over whose signature they appear, and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association.

Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising or business matter should be sent to the Business Manager.

Subscription is included in the annual membership dues. The subscription rate to nonmembers is $3.50 a year in advance, this rate applying to both domestic and foreign subscribers. All foreign subscriptions are to be paid in United States money.

Editorials

CONFERENCE ON SOCIAL SECURITY

As generally noted in the press, a meeting of the Committee on Social Security was held at the Mayflower Hotel, Washington, D. C., Nov. 14, 1934. This meeting was the outcome of the appointment by President Roosevelt, June 9, of a committee headed by Frances Perkins, Secretary of Labor, and consisting of Attorney General Cumming; Secretary of the Treasury Morgenthau; Secretary of Agriculture Wallace, and Mr. Harry L. Hopkins, Federal Emergency Relief Administrator. The reason for appointing this committee was to make such studies as to bring to President Roosevelt certain information whereby he might be properly advised as to what course should be pursued to bring to the people of the United States a greater degree of social security through the enactment of laws in the Congress of the United States.

It was further devised that an advisory committee of twenty be appointed, the chairman of which is Mr. Frank P. Graham, presi-

dent of the University of North Carolina. In addition to this advisory committee, a number of technical advisory boards were appointed to advise the technical staff in the formulation of programs for the various activities to be followed by the committee.

The Dental Advisory Board appointed by Secretary Perkins, consisting of eleven members, is as follows: Dr. Frank M. Casto, President of the American Dental Association, Cleveland; Dr. J. Ben Robinson, president of the American College of Dentists, Baltimore, and Drs. LeRoy M. S. Miner, Boston; Alfred Walker, New York City; John T. Hanks, New York City; George A. Coleman, Philadelphia; O. W. Brandhorst, St. Louis; Herbert E. Phillips, Chicago; J. T. O'Rourke, Louisville; Bissell B. Palmer, New York City, and Roy Green, Sacramento.

This board requested Secretary Perkins to allow them more time to pursue their studies.

As noted in the Nov. 24, 1934 issue of *The Journal of the American Medical Association,* President Roosevelt at the National Conference on Economic Security, November 14, made the following statement on the subject of old age pensions and sickness insurance:

> I do not know whether this is the time for any federal legislation on old age security. Organizations promoting fantastic schemes have aroused hopes which cannot possibly be fulfilled. Through their activities, they have increased the difficulties of getting sound legislation; but I hope that in time we may be able to provide security for the aged—a sound and uniform system which will provide true security.
>
> There is also the problem of economic loss due to sickness—a very serious matter for many families with and without incomes and therefore an unfair burden upon the medical profession. Whether we come to this form of insurance soon or later on, I am confident that we can devise a system which will enhance and not hinder the remarkable progress which has been made and is being made in the practice of the professions of medicine and surgery in the United States.

Here is an encouraging note of conservatism from the Chief Executive of the Nation, and it would seem to indicate that due deliberation is to be given the question of social security as it affects the health and welfare of the people. And there never was a time when deliberation was more essential than it is at present. *The Journal of the American Medical Association* has valiantly fought the battles of the medical profession on this question of the socialization of medical practice, and every argument used against socialization in medicine applies with equal force to the practice of dentistry.

Our Association will be greatly strengthened by the pledge given by Dr. Olin West, secretary of the A.M.A., at the meeting of the Ad Interim Committee of the American Dental Association, November 20-21, to the effect that he would gladly place at the disposal of the Association all of the information at his command on this subject.

That the interests of the people are to be safeguarded as far as our Association is concerned is indicated by the activity of our present Committee on Economics. At the meeting in November, various conferences were held by the Executive Committee of the Committee on Economics consisting of Edward H. Bruening, Omaha, John T. Hanks, New York City, Harold W. Oppice, Chicago and Lon W. Morrey, Director of the Bureau of Public Relations, in the Central Office.

After careful consideration of the various subjects which came to a focus as the outcome of the Conference on Economic Security and the interest which has been displayed in reference to health insurance, the Committee on Economics prepared the following resolution, which was presented to the Ad Interim Committee for consideration:

> The American Dental Association is opposed to the enactment of legislation along the lines of so-called compulsory health insurance until the health professions are thoroughly satisfied that the interests of the public and the professions are properly safeguarded.

The Ad Interim Committee, after considering this resolution carefully, adopted it unanimously. Harry B. Pinney, Secretary of the American Dental Association, has sent out an official communication to the state officers embodying this action.

There are certain agencies in the medical and dental professions that seem obsessed with the idea that for some reason and in some way the whole fabric of health service must be entirely revolutionized and swept away as of no account. The stable institutions of medicine and dentistry that have been built largely through the devotion and initiative of professional men and women, and that have served the people creditably and to the benefit of all, are being decried and scorned as of no avail, and we are asked to place our destiny in the keeping of agencies that know nothing whatever of the functions of real professional service.

What do state legislatures generally know about the most effective and acceptable provisions for the care of the health of the people? Some of these legislatures are doing a most creditable piece of work in the way of protecting the people of their respective states by enacting laws tending to suppress quackery, unprofessional advertising and other questionable practices, but no state legislature could ever be expected to administer successfully the most approved policies of medical or dental service to our citizens. Any attempt on the part of the state to interfere with established principles of professional practice, or to control in any way the policies that should govern this practice, would be disastrous and full of peril to the people.

And it is bad enough to have propagandists wholly lacking in vision outside the professions clamoring for our heads and seeking to direct our destinies and govern our policies, but when the members in our own ranks begin to lose their balance and join in the general aberration, it is a spectacle to call for serious consideration on the part of sane and level-headed citizens, and in particular on the part of all of the members of the professions themselves. This is a period in our history when all of the acumen and intelligence of the people, both lay and professional, are needed to maintain our mental balance and conserve the best interests of our citizens as a whole. This can be done only through the medium of opposing in every way in our power any inroads on our long-established practice that has stood the test of centuries, and rejecting the *ignis fatuus* of state medicine or state dentistry.

THE RESPONSE FROM THE SEALS

One thing seems to stand out most conspicuously this year in the comments made by our members in the responses to the appeal for funds from the Christmas seals. Every year, there come to the Central Office numerous observations on the part of the rank and file of the membership as they are impressed more and more with the importance and significance of this really outstanding activity of our Association. To bring relief to the infirm and needy among our

own members is a fundamental obligation that not only reverts directly to the inner circle of our organization but also irresistibly appeals to us on the ground of a common humanity.

At this Christmas, there seems to be a more dominant note than usual of a militant optimism, and a more nearly universal determination to help, even in cases wherein the individual has himself suffered the "slings and arrows of outrageous fortune." In some instances, when the member has felt the pinch of circumstances, and has thus been able to send only the minimum amount, and in others, when the circumstances were so very difficult that nothing at all could be sent, there was at the same time such a general attitude of spontaneous appreciation of the movement that it was most heartening to all of those who are in any way associated with this activity.

A few intimate and appealing expressions in the letters will serve to indicate the general attitude of mind of the members. One man says: "Impossible to help this year as we are expecting a new baby within the week, and our older girl is now in the isolation hospital with scarlet fever." Surely here is a case calling for sympathy—may the new baby bring joy to this household and the dear little girl soon be out of the hospital.

Another says: "Enclosed please find express money order for $2.00 for Christmas seals. Wish it was more but it cannot be done this time. Will try to do better next time." "The enclosed is for relief. Wish it could have been three hundred!" "Greatly appreciate the work you are doing." "The design on the stamp is the best we ever had." "Have not made a dollar for over three years, am past 70, but am enclosing $1.00." "I have never missed yet—please credit." "Would like to send more but have spent a fourth of this year in a hospital." "Owing to an injury which has incapacitated me for the last sixteen months, I have not been able to carry on my practice."

And so on, and so on. In nearly every letter containing a remittance, the observation is made "I wish it could be more," and this seems to be the dominant note, the almost universal sentiment of our members.

Of all the laudable enterprises fostered by our Association, not one appeals more intimately or sympathetically than this. It touches

the hearts of the membership and makes common cause with all of the impulses of our better nature. Its influence reaches out the helping hand to every one of those who are sorely in need, and cements a bond of fellowship that makes us see more nearly eye to eye than any single activity of our organization.

If every one of our members could be granted the privilege of looking into the homes of some of our worthy brothers who have been helped by this beneficence, and see the sunshine that it has brought into their lives, it would expand the hearts of the members and add immeasurably to the philanthropic stature of the profession as a whole. The good that this activity accomplishes is not confined to the relief of the needy members themselves, but every time a contributor donates something of his substance for the upbuilding of the fund, it expands his sympathies and makes of him a better citizen and a better man. No individual ever hampered himself appreciably by contributing his mite to this fund, but the aggregate has resulted in one of the noblest expressions of man's humanity to man that has ever been witnessed in any activity of professional life.

It is little wonder that the response to the appeal for funds grows greater every year as the character and magnitude of this beneficence becomes more widely known, and more intimately brought home to our members. Gratitude is herein expressed on behalf of the Relief Commission and Relief Committee for the very praiseworthy showing this year in the face of present economic difficulties. It is a chapter in our Association story that may well be contemplated with the greatest possible satisfaction and felicitation.

A FEW REFLECTIONS ON THE DEPRESSION AND ITS CURE

Doubtless there has been a depression, and doubtless it is not entirely over yet, but in the light of calm second deliberation, let us ask if there has not been much loose thinking in connection with the depression, and much unbalanced action in our attempt to remedy it.

Let us begin by asking if this is the first depression that we have

ever had. At once, we are met with the vociferous acclaim that it is the worst one we have ever had, but—is it? Mayhap we have forgotten. How much worse off are we today than we have frequently been in so-called normal times? What basis is there for our present lamentations? It is true that for several years we lost our bearings and went what in the vernacular is called "hay-wire," but those several years were not the years after 1929, but the years before 1929. It was during those years that we exhibited the greatest aberration of judgment, and forgot entirely the essential verities of our existence. We speculated beyond the bounds of common sense and sanity, and developed a frenzy for getting something for nothing. We grew soft mentally and emotionally, and now we whine and recoil when fate reaches out and asks that we stand and deliver. We do not like punishment, and we have been getting some of it; mayhap it will do us good.

It is true that some of us have suffered more than we should, and some have gone down to defeat who were deserving of better things; but has this never happened before in the history of the world? Has the ship of economics always proceeded on an even keel, and sailed forever in calm waters?

And is it not rather farcical to talk of depression and want when our streets are so crowded with automobiles that a pedestrian can hardly get across? Talk about pining for the necessites of life when a ball game, a prize fight or a wrestling match will draw thousands and thousands of dollars at the gates. We complain when people willingly pay more for cosmetics than they do for dental service, but why should we? It is our business to educate the people as to the value of our service as compared with lipsticks and synthetic eyebrows, and we are doing that very thing. We may not be limiting the use of lipsticks, but gradually we are convincing the people that dentistry is a necessity in any civilized community. Say what we will, the teeth of the American people are better cared for than are those of most other nations. Not that they are as well cared for as they should be—Utopia is not here yet—but the dental profession of this land of ours has small warrant to complain in contradistinction with other activites of our lives.

And consider the lot of the dentist of today as compared with that

of the pioneers of the profession. Might it not be salutary for us to hark back a bit to the early days of dentistry, and note the hardships and the lack of privileges that were the common lot of the profession in the memory of men still living? Many members of the profession own and drive an automobile today, with all that this luxury implies. Most heartily do we approve of this, and right happily do we contemplate the spectacle of dentists enjoying the benefits of this modern accessory to pleasure and comfort, but the cost of an automobile would have been an insuperable barrier to the possession of such a luxury on the part of most of the dentists of the early days —even if automobiles had been invented.

What is considered the hardship of the present depression would have been accounted luxurious living in the olden days, and it might be profitable for us to consider the agencies through which we have evolved from the limitations of the past to the privileges of the present. It has all come about through the application of one principle: economy and hard work. These basic essentials seem to have been thrown in the discard of late in our attempts at economic recovery, and another policy has been substituted. Today, we seem to seek a cure for the depression through the agency of extravagance and indolence and this policy has never succeeded and it never will. Neither will the policy of paying or receiving the dole ever cure the condition. It will make it infinitely worse as has already been demonstrated by the numberless cases of able bodied men refusing to work when work is offered them simply because they have been taught to live on the dole. To limit our service and demand that we get higher pay for it is not the road to economic recovery, whether it be in a trade or in a profession. To attempt this is to ignore the essentials of equity and justice, and the essentials cannot and will not be ignored.

A NEW SERVICE

At the meeting of the Ad Interim Committee of the Board of Trustees of the American Dental Association, November 20-21, a new activity was inaugurated whereby important information coming to the Central Office on all matters concerning the welfare

of the Association and the profession is to be released by the Bureau of Public Relations to the editors of the various state and district publications for use in their respective journals or bulletins under release dates specified on each item sent out.

The object is to bring the members in all sections of the country in closer contact with the American Dental Association through the medium of news items, comments on news, reports of the activities of the various committees and summaries of important actions taken at the meetings of the American Dental Association. These press releases will include certain material of a significant character that is to appear in THE JOURNAL. All important activities originating in the Central Office are to be reported in this way.

It is felt that no better medium is available for the dissemination of this information than the local publications, and we trust that the editors will cooperate by relaying this information for the benefit of their readers. The Ad Interim Committee made it clear that it is not intended in the least to interfere with or to curtail any of the departments of THE JOURNAL, but merely to bring this material to the editors of the local periodicals in a comprehensive form ready prepared for their use.

It is expected that editorials for THE JOURNAL dealing with the important issues of the day will be sent in advance to the editors of local societies under the proper release date restrictions. This, with all other material released, may be published with or without amendments or additions, and, if desired, it may be handed directly to the printer in making up each forthcoming issue of the local organ. It is intended as a clearing house for the dissemination of information of interest to every member of the Association, and comments or suggestions are invited from every one who occupies the editorial chair as to what his reaction is to this new activity. The fact should be stressed that it is only through the hearty cooperation of the editors that this movement will be a success.

THE DENTAL GAZETTE: OFFICIAL ORGAN OF THE PUBLIC DENTAL SERVICE ORGANIZATION

An old magazine has taken a new name and announced its pur-

pose. The old name was the *Public Dental Service Gazette;* the new name is the *Dental Gazette.* Under its new pennant, this periodical promises the presentation of scientific and technical articles of practical value and the consideration of matters of political interest to the profession and of concern as regards national health insurance. In its hail to the profession, it says, "We shall not be afraid of controversy, but will rather welcome it," following reference to "political interests." This comment alone gives it distinction. No dental journal on the American continent encourages controversy to save itself from dreariness. The editor seeks opinion as to the *Gazette's* success or failure in keeping this pledge, again putting his journal at the service of his constituency intimately, and his office at the vortex of conflicting but sharpening judgments.

Following the *Ave* of the first pages is a symposium on state dental service, designated as a question of supreme importance—so important in medicine, quotes the introduction from a medical practitioner, that only a brilliant man can hope to draw wealthy members of the community to his practice. For others less luminous, only state medicine will provide a secure means of livelihood. "It is time," says the editor, "we decided our views on the matter and formulated a general policy in connection with it. If we wait until the movement starts, we may be too late." Again: "No one can tell how soon the turn of the dental profession will come."

Now the contributors to the symposium begin, a symposium that is to be carried into future months. There are seven donors of opinion, three of whom are M.P.'s. While their names are not mentioned in this review, it may be taken that they are not rushlights of the profession or they would not be used in the initial issue of the new journal. The first one, an M.P., tells the difficulties in the way of such dental service and says they are "very great," the greatest being a shortage of qualified service. He suggests a cycle of public instruction, to assure an incease of dental school output, which will have a self-adjusting result.

The second is pessimistic in behalf of the profession. There is need, he realizes, but harm will be done the profesion. "How good can be done without harm, I do not know." The third sees dental care as an industrial asset, but consideration must be sufficient "that

the profession does not suffer." The fourth, an M.P., says, "The Labor Party aims at the ultimate provision of a complete, organized and free medical and dental service for every single person in the community. The party holds as a principle that, in the public interest, the state should make itself responsible for such a provision." After stating his willingness to carry through a well-thought-out scheme, he ends with, "But I expect we shall advance by stages as I have indicated."

The fifth, a public dental officer, avers that we must begin with the children and that, after their school days, a state dental service should be conducted by a panel of private practitioners on a capitation basis. The sixth, the third M.P. and chairman of the Dental Board of the United Kingdom, is brief: "There is no likelihood of the matter being seriously considered at present and it would be quite possible to go further and fare worse." That is all he says. The seventh and last states that "every extension of public dental service may depress the work of the private practitioner, but one must remember that it has led to the employment of a great many dentists whose numbers are likely to increase largely."

The foregoing quotations are made for their suggestion. They cause one to halt to reflect and then to reflect again. They are left as they stand that the reader may do his own reflecting. There is thrill in the hum of one's own mental gears. Coming from afar, the comments of the English dentists may make our thinking objective and therefore more trustworthy. It is possible that a page of foreign history might help us in making our own.

The editor's name is not given. Like the editors of our newspapers, he is anonymous. He writes behind an unlettered door. Why? Is it to make his words valuable for their own sake, his ideas discussable without passion? to allow his suggestions to germinate without too much heat or cold? The passing scene may not know him. He may be content not to be known, content because as a shadowy deity he may shape opinion, direct the minds of his readers and hold them to sanity without the extrusion of personality which may add or detract from the result which is more to him than applause.

T.

COMMITTEES

Large associations of men must delegate tasks to certain members. This means the appointment of commissions or committees. For highly specialized jobs, specially trained men are appointed. For duties that do not come within this category, the ordinary man will "do"; and he certainly will if he is intelligent and convinced of the need which his appointment implies.

The first type does not concern us. Scientists, scholars, specialists are not set to useless or ornamental jobs. They would refuse the dubious honor. If the task is important enough for consideration, they accept their function as an obligation. The second type is the one that gives rise to question and skepticism. And the reason is that the work assigned is frequently not pointed, the need not convincingly urgent. The main body will get along if the committee doesn't work; hence, the committee feels no incentive. Frequently, the titular function is to assist, to advise, to share another man's responsibility—at least, to appear to share it. The result is that the committeemen recognize their own unimportance, accept their status for exactly what it is and do nothing.

Establishing that conviction is the fact that the personnel of the committee is widely scattered. They cannot meet in effective session. One member is asked to confer with whomsoever the group is supposed to work under, and pass on to the committee his judgments, proposals and what else. Letter writing is a sterile affair for most men, and the ready reply is "If that seems best, it is O.K. with me," or its equivalent.

If the committee is necessary, why the wide dispersion of the constituency? Is it to get ability from wherever it is to be found or is it a mere "sowing of the seed of peace" by honoring a community in the appointment? The result is uniform. The committee members can't meet; they won't write. Discussion, the light of intelligence, can't burn. What can be expected of them under the circumstances? The thing that happens: Nothing, the enactment of a mere form, nothing.

Still more mystifying to an observer, if effectiveness is the desired

quality in a committee, is the number of men constituting it. Lesser organizations have been known to make from sixteen to seventy-five the range of appointees, the total reaching from one-third to one-half the membership of the parent body. More than a half of these are often incapable of coherent speech, could not express themselves, no matter how clear their thought. The evidence is entirely against effectiveness as the object of such a personnel. A mistake is made in believing that every member of a society must have office or that every member desires office. Most men prize membership not for such cajolery, but for the results obtained by a progressive, productive working force.

If "less than nothing" can be estimated, in some instances that happens. The committee is appointed and its names spread on official stationary. Its job is to assist, advise, support some functionary in high office. A problem arises on which he would like help. The committee comes to mind. He would write the chairman. Perhaps he does. A stronger "perhaps" is that he doesn't. The zigzagging letters from corner to corner of a continent discourage him. He can guess the replies. "If that seems best, etc." There has been no discussion; the problem has come back as it left his hands. He refuses the responsibility. He trusts to time, and time carries off the opportunity it has brought. Result: Nothing minus. How can men who have had no time to consider, men who have no basic premise on which to build consideration, give a valuable judgment? The men themselves appreciate that and take the easy exit.

A committee that can and does function is the only effective committee. Such committees are the driving gears of any social, industrial or other machine. The progress of the whole depends on the effectiveness of the assembled parts. Organizations are glacial in their movements when committees fail. It does seem that any community is better honored by things done than by having a committee member in its midst and things undone.

Again, and finally, committees have been used for decorations in many instances when no ornamentation was necessary. They have been added to offices and become an alibi for the officers, or a detriment to their activities. No job, no official should be encouraged to maintain a status quo. His work should be progressive. Develop-

ment should be demanded at his hands. Events should characterize his domain and not a state of being.

T.

THE MAIL ORDER DENTAL RACKET

Release was made by the Federal Trade Commission at Washington, Dec. 1, 1934, of a statement to the effect that "misrepresentation in the sale of dental plates is prohibited . . . in an order against Benjamin D. Ritholz, of Chicago, doing business under the names of 'Chicago Dentists,' and 'Chicago Dental House, Inc.' "

Among practices enjoined are the use of testimonials, endorsements or guarantees in or through newspapers, magazines, the radio or circulars to represent that the respondent's dental plates are of a value greater than is actually the case; that he can make a properly fitting and satisfactory dental plate from an impression of the mouth taken by a layman for whose use the plate is intended, and that the respondent is using in his manufacture the scientific methods used by dentists.

The findings show that Ritholz manufactures 150 plates a week at his laboratory, 1445 West Jackson Boulevard, Chicago. According to the findings, the laboratory work is conducted by technicians and helpers and the work of making plates is not supervised by dentists.

The Chicago Better Business Bureau reports in its issue of Dec. 6, 1934, a more detailed statement of the activities of this concern. It reproduces the statement from the Federal Trade Commission and goes on to say:

Records of the Chicago Better Business Bureau show that during the past year thirty-one complaints have been received from the public involving practices of the Ritholz dental business. Thirteen involve mail transactions, eighteen resulted from personal visits to local offices. The mail order complaints allege failure of the Ritholz establishment to live up to its "satisfaction or money back" guarantee. In nine instances customers have received satisfactory adjustments only after the Bureau has contacted the firm. The four remaining cases appear to be unadjusted at the present time.

Less than a third of the local complaints appear to have been adjusted. The typical local complaint alleges that, upon responding to Ritholz advertising in which plates at $3.95, $4.95, etc., have been offered, the complainant has been told that he "could not be fitted at that price," but must pay from $25.00 to $60.00 for teeth. Even the higher price plates have not satisfied the purchasers in many instances, complaints indicate.

To summarize the number and character of complaints made against the concern by disappointed patrons would naturally be im-

possible with such an output of dentures made under the conditions indicated, and we are glad to lend our endorsement to the efforts of the Federal Trade Commission and Better Business Bureau in their attempts to suppress such nefarious practices.

It is bad enough for imposters to prey on the public when the damage to the citizens relates to a monetary loss, but it is infinitely worse when charlatans invade the province of legitimate professional service, and injury and imposition are worked on the physical well-being of the people themselves. To rob a man of money is one thing; to undermine his health and interfere with his comfort and happiness by deforming his features is a much more serious matter.

In May, 1933, the American Dental Association, through its Secretary, Dr. Harry B. Pinney, sent out a communication calling attention to the methods of this concern, and now that the matter has been ventilated by the Federal Trade Commission and Better Business Bureau, we trust that constructive efforts may eventuate in the suppression of such a pernicious practice.

One of the agencies through which imposition of this sort may be prevented, or at least discouraged, is united effort on the part of organized dentistry, with a solid front against such practices. When concerns of this character realize that, in addition to the opposition just indicated on the part of organizations outside the profession, there is also combined the concrete antagonism of associations in the profession itself, they are likely to think a second time before launching such schemes, and the reputable element in the profession should leave no stone unturned to register their protest.

THE DEATH OF DR. FLORESTAN AGUILAR

Word has been received of the passing of Dr. Aguilar on Nov. 29, 1934, in Madrid, Spain.

Dr. Aguilar was one of the most noted dentists in the world. Internationally, he was probably better known than any dentist of his time. He had been given all of the honors that could be bestowed on him by the profession and his government.

He was an expresident of the International Dental Federation and for many years its secretary. In the councils of the profession, he was always given a leading part.

The full particulars have not at the present writing been obtained as to the nature of his illness, though it had been known for some time that he was not well. Fuller particulars will appear in a later issue.

A great man has gone, and one who will be missed by a wide circle of friends both social and professional.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Polishing Metallic Fillings—After stoning and disking with both sandpaper and incorporated pumice disks, the use of dicalcium phosphate, A.D.R., on a rubber cup will ensure a high polish to all metallic fillings.—*L. E. Kurth, Chicago.*

Towel on Headrest—By placing a clean towel over the headrest of the dental chair and keeping it secure with a rubber band, we assure each patient a clean place to rest his head. It is surprising how dirty each towel gets. Each patient is entitled to this service.—*E. T. Klein, Washburn, N. D.*

Temporary Rebasing—For temporary rebasing of dentures, a powder made of zinc oxide, 85 parts by weight, and powdered resin, 15 parts by weight is mixed with a liquid made of oil of cloves, Canada balsam, and balsam of Peru in the relative proportions of 60, 35 and 5 parts, to flowing consistency.—*Accepted Dental Remedies.*

Trimming Wax Impressions—A simple and fast method of trimming down wax impressions of inlays and three-quarter crowns after removing the matrix calls for the use of a coarse sandpaper disk on the engine. It has an advantage over an instrument in that it shapes the margins so that less finishing is needed. A finer disk may be used for a smooth finish.—*J. Robert Keane, Los Angeles, Calif.*

The Damage of Clasps—The deleterious effect of clasps or retainers on the tooth which they surround is all too apparent. Call it what you choose—erosion, abrasion, electrolysis, or just old-fashioned decay, the tooth substance has vanished while we have been name hunting. Clasps are badly needed sometimes too, but not nearly so frequently as we have been led to believe. Claspless partial upper dentures covering plenty of roof will stay where they belong with a sprinkling of plate powder. Some patients are adverse to the use of powder, but are more adverse to the loss of teeth.

The mouths of patients using plate retaining powder are usually more normally pink than those of patients who do not use it.—*Herbert Ely Williams, Red Bank, N. J.*

Advice to Denture Patients—In many sections, it is still common practice to render the mouth edentulous, then allow several months to elapse before inserting full dentures. During this period, the patients are compelled to subsist largely on very soft foods. Granting perfect fitting dentures are subsequently inserted, the prosthodontist is puzzled when, after a few days, the patient appears, complaining of several very tender areas. Aphthous ulcer have formed because of an acute stomatitis, due to the ingestion of foods to which the system has become unaccustomed. Patients will eat large quantities of those foodstuffs that the system has been without for a long period, especially foods that they have developed a ravenous appetite for. Prosthodontists can spare themselves and their patients much trouble by counseling caution regarding the overeating of foods patients have gone without for so many weeks.—*E. G. Huwatschek, Fort Washington, Wis.*

Development of Dental Radiographs—The variation in exposure required for different patients and different regions of the same patient creates a problem which has not been solved by standardized methods. Biologic factors generally do not conform to standardization. Regardless of how carefully the exposures are calculated, dental radiographs will differ in shade when they are developed exactly five minutes in fresh developer at a temperature of 65 degrees. The method must be modified to obtain the desirable uniformity and to avoid extreme differences in density. For those who must develop by time and temperature, the modification can be secured by developing one film of each pair of films four and one-half minutes and the other five and one-half minutes. This will give a choice of shades in each pair, which makes it possible to select a group of more nearly uniform density. Development by inspection offers the greatest opportunity for modification, and it can be learned easily.—*Clarence O. Simpson, St. Louis, Mo.*

Simplifying Dental Bookkeeping—Bookkeeping, for the dentist, is always an unwelcome and irksome task, particularly if he has to do it himself. Hence, the easier that it is made, the more popular it will be with the average practitioner. The minimum amount of equipment for this purpose consists of an appointment book, examination blanks, a loose-leaf ledger and a permanent income and expense record book. No. 3 S. S. White examination blanks have been found practical. If an accurate record of the examination is kept and a system is adopted which shows which work is completed at each sitting, it is very easy to make a record of the work done in the loose-leaf ledger. A ledger sheet made by the Irving-Pittman Co., especially for the use of the dentist, known as form P-204, has been found to be most practical. A record is made on the appointment book of cash and credit items every day for each patient and these can then be transferred to the ledger sheet, as well as the permanent income and expense book kept for income tax purposes. A duplicate receipt record, one to give the patient and the other to be retained by the dentist, is an excellent investment, as it will settle many a dispute which may arise over the settlement of accounts. It also is valuable as a positive check should the dentist fail to enter any items of income on his appointment book.—*R. N. Douglas, Elkhart, Ind.*

COUNCIL ON DENTAL THERAPEUTICS

CALOX TOOTH POWDER—NOT ADMISSIBLE TO ACCEPTED DENTAL REMEDIES

Calox Tooth Powder was considered by the Council on Dental Therapeutics on two occasions, in 1931 and recently. The report which follows was sent to the firm after adoption by the Council. The firm replied that although their opinions on Calox Tooth Powder differed from those of the Council, they "would be delighted" to change their opinions "to conform entirely to those of the Council were it not for the fact that at the present we have a tremendous investment in finishing materials, in advertising, contracts, copy and display material which can not, because of economic reasons, be cast aside at this time." They added that "it therefore becomes necessary for us to request that further consideration of CALOX be delayed until such time as it is possible for us, from an economic standpoint, to revise our materials to conform to the opinion of the Council."

The Council considered carefully the statements of McKesson & Robbins. It was apparent from advertising which had been appearing in the lay press and in journals addressed to druggists that McKesson & Robbins, Inc., were making a wide appeal for the distribution of this product on the basis of claims held objectionable and unwarranted by the Council.

The Council postponed consideration until about Nov. 1, 1934, in order to give the firm an opportunity to bring their advertising and product in conformity with the recommendations of the Council. If the firm failed to carry out these necessary changes in the interest of the dental profession and the public, it was determined that the publication of the report about December 1 would be considered. The firm did not avail themselves of this opportuntiy. The Council therefore authorized publication of the following report for the information of the dental profession.

SAMUEL M. GORDON, *Secretary.*

Calox Tooth Powder was considered by the Council in 1931 at the request of the firm. At that time, it was held inadmissible for Accepted Dental Remedies, principally because a quantitative statement of composition was not given. This was held to be important in view of statements in advertising that "every lot is carefully standardized," and because of certain claims involving such expressions as "superior dentifrice" and stressing the neutralizing properties of Calox Tooth Powder, as well as bacterial claims. The Council also questioned the inclusion of two potential oxygen liberators, such as sodium perborate and calcium peroxide, and objected to the claim based on the release of nascent oxygen.

It was pointed out in the report sent to the firm at that time that the situation was in conflict with the Council's position on dentifrices, as the Council held, then as now, that the expected function of a dentifrice can be only as an aid in cleaning the surfaces of the teeth when used in conjunction with a toothbrush.

Calox Tooth Powder is now said to be composed of:

Magnesium carbonate	2.025%
Flavoring oils	4.375%
Heavy chalk	39.600%
Light chalk	21.000%
Sodium perborate	10.000%
Calcium peroxide	1.000%
Powdered soap	11.000%
Powdered sugar	11.000%
	100.000%

Calox is apparently made according to two patents which have already expired (Patents No. 760,397 and No. 802,099).

Tests for determining the calcium and magnesium and available oxygen are given. The analytical tests leave much to be desired since they do not differentiate between the calcium as carbonate and as peroxide. The same may be said for the procedure for determining the available oxygen in Calox, since differentiation is not possible between the oxygen available from the calcium peroxide and that available from the sodium perborate. This should not preclude acceptance of the product by the Council, since the Council, as a rule, does not, at the present time, require tests for other products of this sort, unless definite claims in this respect are made in their promotion.

The firm states:

> The calcium peroxide and sodium perborate are included in the formula of Calox not alone for their available oxygen, but for the reason that calcium peroxide, on contact with the moisture of the mouth is changed to calcium hydroxide, which we believe is useful in assisting in the maintenance of mouth health, and although *we make no claims for this,** experience has shown that the formula is a good one, as attested to by thousands of dentists.

The foregoing statement is in conflict with statements appearing in advertising, namely:

> This ingredient (sodium perborate) in combination with others, is the reason why Calox Tooth Powder releases oxygen and lime water on contact with moisture in the mouth. The oxygen penetrates the tiny crevices between teeth, which other dentifrices may not reach. *The lime water neutralizes acidity in the mouth, protecting tooth enamel from acid destruction.** Besides, the breath is definitely deodorized and sweetened.

The Council cannot admit that induced substances, whether alkaline or acid, materially alter the reaction of the saliva and thus neutralize acidity in the mouth. Indeed, it is well established that the reaction of the saliva is slightly acid, but close to the neutral point. Nor has it been demonstrated that the addition of alkalis in larger amounts than are available in Calox Tooth Powder can neutralize acidity in the mouth and protect tooth enamel from acid destruction. If the action of calcium hydroxide is desired, would it not be more simple to use lime water, which is readily and inexpensively prepared?

One of the advertisements states: "Old dentifrice ideas turned up-side down." As a matter of fact, lime water was used in the early days of dentistry, on the theory, now exploded, that it neutralized "mouth acids."

Much is made, in the promotion of Calox Tooth Powder, of the sodium perborate contained therein. A previous report of the Council sent to the firm objected generally to the claims based on sodium perborate, because of its implied therapeutic properties.

Present newspaper advertising states: "Calox is a tooth powder which contains sodium perborate used by dentists and physicians to treat Vincent's infection or trench mouth." Some dentists and physicians also use chromic acid and sodium sulphide in treating Vincent's infection, yet no one would be naive enough to recommend its use to the public. Sodium perborate is one of a great number of drugs used in the treatment of Vincent's infection. Indeed, it has been demonstrated that the amount of oxygen that may be liberated from sodium perborate under actual conditions of use in the mouth is small. Nor should sodium perborate be considered as a drug devoid of potentialities for harm. Hirschfeld[1] has reported several cases of "chemical burns" from the improper use of sodium perborate.

The use of statements such as those quoted above, in public advertising, leads to a sense of false security. It implies therapeutic effects from the use of tooth powder, a type of

*Italics not in original.

1. Hirschfeld, Isador: Vincent's Infection of the Mouth: Clinical Incidents in Diagnosis and Treatment, J.A.D.A., 21:768 (May) 1934.

advertising for dentifrices that cannot be condoned. Therefore, such statements are in conflict with the Council's provisions in reference to dentifrices.

The following statement in advertising is objectionable: "The oxygen penetrates the tiny crevices between teeth which other dentifrices may not reach." This is objectionable in view of the fact that no evidence is available that even if the oxygen penetrated the tiny crevices, it is useful, and in view of the fact that sodium perborate does not liberate all of its oxygen when dissolved in water or saliva. Furthermore, it must be appreciated that the sodium perborate is quite insoluble in water.

Throughout the advertising, the claim that it whitens teeth appears. For example:

> But How It Whitens Teeth! . . . removes stains, retards tartar. . . . Film and stain are speedily removed. Dull teeth begin to shine. . . . You will like the speedy way it removes film and stains. See how it makes dull teeth shine.

It is apparent that the teeth cannot be whitened, and the use of the term "whiten" as understood by dentists implies bleaching properties. The Council, acting on the insistence of dentists, has opposed the use of the term whiten in advertising a dentifrice. Although claims have been made that dentifrices clean the teeth, it is difficult to demonstrate this. Therefore, references to the use of the cleansing action of tooth pastes must adhere to generalities. When claims of specific superiority are made, the Council cannot accept them unless they are supported by adequate evidence.

The claim is made that the breath is definitely deodorized and sweetened. The Council does not object to the expression "sweetened," but the deodorizing claims are objectionable. The Council does not feel it necessary to discuss in detail the false sense of security that may arise by covering up one odor with another.

It is a question whether Calox Tooth Powder, of the complex composition presented above, will do more when used as a dentifrice than a mixture composed of magnesium carbonate, precipitated chalk, sodium perborate, and/or soap, flavored with saccharine (or sugar) and essential oils, or the following simple formula of the Philadelphia Dental Dispensary:

Calcium carbonate, precipitated	95 parts
Castile soap	3 parts
Saccharine	⅛ part
Oil of birch	1 part
Oil of peppermint	½ part

The rationality of including both heavy and light chalk as abrasives is not apparent. No standards or physical properties are available for the heavy and light chalk. The Council at this time is requesting the chemical and physical standards of these materials with particular reference to abrasiveness and particle size.

Container.—The following appears on the containers: "The Perfect Dentifrice. A Scientifically Prepared Tooth Powder." It may be stated that the "perfect" dentifrice is not known. From the foregoing it is apparent that the basis for the claim "Scientifically Prepared Tooth Powder" is not apparent.

Newspaper advertising states: "Calox Tooth Powder is the crowning achievement of our world-famous research laboratories." This appears to be the puff of an advertising man and a statement which the Council cannot condone. The firm cannot seriously mean that Calox Tooth Powder is their crowning achievement.

Advertising further refers to " . . . this scientifically prepared 5-way dentifrice. . . ." The expression "5-way dentifrice" apparently refers to "antacids," "hygienic agents," "cleaning and polishing ingredients" and "deodorants." A dentifrice can be considered only as a one-way dentifrice; that is, for whatever usefulness it may have in aiding the toothbrush in cleaning the surfaces of the teeth.

Emphasis should be removed from the sodium perborate and calcium peroxide as pointed out above.

In a circular which accompanies the trade package, there appear references to a number of McKesson products which the firm states will be deleted.

Newspaper and magazine advertising carries references to certain of McKesson products, such as Albolene, Analax, Ibath, Shavami and Soretone. The Council cannot consider a product for acceptance with the understanding that the acceptance will be used to promote the sale of other unacceptable material.

It is recommended that Calox Tooth Powder, as being promoted at the present time, be held unacceptable for Accepted Dental Remedies. It is further recommended that if the firm agrees to carry out the changes suggested in the foregoing discussion, the Council will agree to consider the product further.

MORE MISBRANDED DENTAL NOSTRUMS

Since the establishment of the Bureau of Chemistry and the Council on Dental Therapeutics, the number of seizures of dental products, marketed in interstate commerce in violation of the Food and Drugs Act, have been numerous. It has been the practice to list in these pages short abstracts of the Government's action in order to apprise the dental profession of this work.

Beginning with this issue of THE JOURNAL, the actions of the Government for violation of the Food and Drugs Act on dental medicines are abstracted to contain the following essential information: name, composition and findings of the court. Those desiring more information on any of the products listed below can secure it by writing to the secretary of the Council on Dental Therapeutics.

SAMUEL M. GORDON, *Secretary*.

Pyor-Heal.—Brander Co., New York, N. Y. Composition: phenols, resins, free alkali and water. Claims regarding treatment of pyorrhea, gingivitis, Vincent's angina, etc., were false and fraudulent. (Notice of Judgment 18506, issued March, 1932.)

Vernas.—Vernas Chemical Co., Paterson, N. J. Composition: zinc chloride, glycerin, alcohol (23.2 per cent by volume) and water flavored with cinnamon oil and peppermint oil. Claims regarding the alleged antiseptic effects of the article were false and fraudulent. (Notice of Judgment 18508; 18550, issued March, 1932. Notice of Judgment 18678, issued May, 1932.)

Blackstones' Tooth Paste.—Blackstone Manufacturing Company, Newark, N. J. Composition: compounds of calcium, magnesium, zinc, carbonates, glycerin, soap and water, colored with a red dye. Claims regarding the antiseptic effects of the dentifrice were false and fraudulent. (Notice of Judgment 18513, issued March, 1932.)

Palmiacol.—Simmon Co., Cleveland, Ohio. Composition: a fatty substance, creosote and water. Claims regarding the use of the article as an antiseptic, germicide, were false and fraudulent. (Notices of Judgment 18517, 18518, issued March, 1932.)

Pyro-Chex Antiseptic Liquid and Pyro-Chex Complete Treatment.—Pyro Chex Co., Wichita, Kan. Composition: zinc chloride, sodium chloride, hydrochloric acid, phenolic substances, menthol, alcohol and water. Claims regarding treatment of pyorrhea and other dental troubles were false and fraudulent. (Notice of Judgment 18525, issued March, 1932.)

Neu-Carb.—Gibson-Howell Co., Jersey City, N. J. Composition: calcium carbonate (42 per cent), magnesium carbonate (15 per cent), starch, talc and a bland oil (4 per cent), flavored with peppermint oil. Claims regarding pyorrhea, acid mouth, etc., were false and fraudulent. (Notice of Judgment 18534, issued March, 1932.)

Pycopé.—McKesson, Langley & Michaels Co., San Francisco, Calif. Composition:

sodium chloride, sodium carbonate, sodium bicarbonate, borax, calcium carbonate, iron, aluminum and magnesium compounds and flavoring materials. Claims for prevention of pyorrhea, etc., were false and fraudulent. (Notice of Judgment 18671, issued May, 1932.) (Note: The composition of Pycopé has been changed and the claims made acceptable to the Council.)

Cocil-Cod.—Serra, Garabis & Co. (Inc.), San Juan, P. R. Composition: extracts of plant drugs including eucalyptus, a small proportion of menthol, a trace of chloroform, alcohol (7.7 per cent by volume), sugar and water. It contained no cod liver oil nor cod liver oil extract. Claims for strengthening patient's resistance, treating coughs, etc., were false and fraudulent. (Notice of Judgment 18682, issued May, 1932.)

Cerevisine Tablets,—E. Fougera & Co., New York, N. Y. Composition: dried yeast. Claims for treatment of diabetes, use as a tooth paste, etc., were false and fraudulent. (Notice of Judgment 18696, issued May, 1932.)

Teethina.—C. J. Moffett Medicine Co., Columbus, Ga. Composition: bismuth subnitrate, calcium carbonate, sodium citrate, calomel, and sugar, flavored with ground cinnamon. Claims for use in treating teething babies were false and fraudulent. (Notices of Judgment 18729, issued May, 1932; 18730, issued May, 1932; 18929, issued June, 1932; 19185, issued Oct., 1932.)

Pyorkil.—Pyorkil Co., Catlettsburg, Ky. Composition: potassium permanganate and sodium chloride dissolved in water. Claims regarding pyorrhea were false and fraudulent. (Notice of Judgment 19732, issued May, 1932.)

Dr. Welters' Tooth Powder.—E. A. Welters Tooth Powder Co., Jacksonville, Fla. Composition: calcium carbonate, soap, alum and peppermint oil. Claims regarding use as an antiseptic tooth powder were false and fraudulent. (Notices of Judgment 18746, issued May, 1932; 19031, issued July, 1932.)

Alphozone.—Frederick Stearns & Co., Detroit, Mich. Composition: succinic peroxide and succinic acid. Claims regarding the use of the article as a germicide for general use were false and fraudulent. (Notice of Judgment 18748, issued May, 1932.)

Germozone.—Geo. H. Lee Co., Omaha, Neb. Composition: sodium chloride, aluminum sulphate, potassium permanganate, potassium chlorate and water. Ozone was not present. Claims for use as an antiseptic and healing remedy, equally effective for man or beast; for man, to be used as wash for mouth or throat, etc., were false and fraudulent. (Notice of Judgment 18926, issued June, 1932.)

Sozodont Liquid.—Hall & Ruckel (Inc.), New York City. Composition: glycerin, borax, soap, alcohol and water, flavored with menthol, and methyl salicylate, colored with a red dye. Claims as an antiseptic liquid for use in massaging the gums were false and fraudulent. (Notices of Judgment 18927, issued June, 1932; 19365, issued November, 1932.)

Lavodin.—Lavodin Co., Oakland, Calif. Composition: potassium iodide, sodium chloride, borax, cassia oil and glycerin, alcohol (7.9 per cent), and water, colored with a red dye. Claims regarding pyorrhea, trench mouth, etc., were false and fraudulent. (Notices of Judgment 18928, issued June, 1932; 19040, issued July, 1932.)

Davies' Geng-Seng.—Davies' Geng-Seng Co., Los Angeles, Calif. Composition: powdered ginseng root, aloe, magnesium sulphate, sodium bicarbonate and sugar. Claims regarding indigestion, ulcerated and bleeding gums and acid poison were false and fraudulent. (Notice of Judgment 18932, issued June, 1932.)

Pheno-Septol. Phenol-Septol Co. (Inc.), Rochester, N. Y. Composition: phenol, a salicylate, a borate, alcohol, a potassium salt, and flavoring materials such as benzaldehyde and menthol dissolved in water, colored with an orange-colored dye. Claims for the use of the article as an antiseptic and germicide for use as a mouth wash, dentifrice, etc., were false and fraudulent. (Notice of Judgment 18938, issued June, 1932.)

Phen-Amy-Caps.—Franklin Laboratory, Portland, Me. Composition: capsules con-

taining in each acetphenetidin (60 mg.), amidopyrine (223 mg.), caffein (26 mg.) and an extract of a mydriatic drug such as hyoscyamus. Claims for relief of toothache, pain, neuritis, etc., were false and fraudulent. (Notice of Judgment 18939, issued June, 1932.)

Stevens Anti-Amebic Dentifrice.—Stevens Medical Manufacturing Co., Brooklyn, N. Y. Composition: calcium carbonate, soap, a gum, a small proportion of ipecac alkaloids, volatile oil, including peppermint oil, glycerin and water. Claims for the prevention and treatment of pyorrhea, etc., were false and fraudulent. (Notice of Judgment 18940, issued June, 1932.)

S. B. Kitchel's Liniment.—S. B. Kitchel Co., Coldwater, Mich. Composition: ammonia (4 per cent), sodium and potassium carbonate (1 per cent), trace of iron sulphate and tannin, water (approximately 95 per cent). Claims regarding toothache, sore throat, inflammation, etc., were false and fraudulent. (Notice of Judgment 18944, issued June, 1932.)

Seelye's Wasa-Tusa.—A. B. Seelye Medicine Co., Abilene, Kan. Composition: chloroform, ether, ammonia, alcohol, a volatile oil such as camphor oil, and water. Claims regarding toothache, sore throat, etc., were false and fraudulent. (Notice of Judgment 18948, issued June, 1932.)

Tolysin Tablets.—Calco Chemical Co. (Inc), Bound Brook, N. J. Composition: neocinchophen (0.31 gm. per tablet), starch and talc. Claims regarding neuralgia, neuritis, headaches, etc. were false and fraudulent. (Notices of Judgment 18949, issued June, 1932; 19054, issued July, 1932.)

Molo.—McKesson Western Wholesale Drug Co. (Ltd.), Los Angeles, Calif. Composition: zinc chloride and iodide, glycerin, alcohol (6 per cent), pink coloring matter, water. Claims as an iodine mouth and throat antiseptic were false and fraudulent. (Notice of Judgment 18958, issued June, 1932.)

Takara Hygienic Powder.—Takara Laboratories, Portland, Ore. Composition: boric acid, ammonium alum, phenol and menthol. Claims regarding use as germicidal douche or for common sore throat, etc., were false and fraudulent. (Notices of Judgment 18971, issued June, 1932; 19371, issued November, 1932.)

Co-Liv-Oil.—Silmo Chemical Co. (Inc.), Vineland, N. J. Composition: fish oil, calcium and magnesium carbonates, small amounts of iron and aluminum compounds, water. Claims as preventive of leg weakness, to build better bone, etc., were false and fraudulent, as it was not emulsion of cod liver oil and contained no vitamin D. (Notice of Judgment 18972, issued June, 1932.)

Vilane Powder.—Blackburn Products Co., Dayton, Ohio. Composition: borax, sodium chloride, sodium bicarbonate, thymol, menthol, methyl salicylate and eucalyptol. Claims as disinfectant, for use in sterilizing teeth, teething, etc., were false and misleading. (Notice of Judgment 18974, issued June, 1932.)

Magic Salve Heal-Al.—Ericka Manufacturing Co. (Inc.), Springfield, Mass. Composition: petrolatum, peppermint oil, 6 per cent. Claims for use in toothache, neuralgia, etc., were false and fraudulent. (Notice of Judgment 19027, issued July, 1932.)

Steketee's Neuralgia Drops.—Hazeltine & Perkins Drug Co., Grand Rapids, Mich. Composition: Peru balsam, volatile oil, alcohol (45.6 per cent) and water. Claims regarding use in neuralgia were false and fraudulent. (Notice of Judgment 19028, issued July, 1932.)

Hien Fong Essence.—Knorr Medical Co., Detroit, Mich. Composition: volatile oils (1.2 per cent), including spearmint oil, peppermint oil, and camphor, a small proportion of ether, extracts of plant drugs, alcohol (52.5 per cent by volume) and water. Claims for use in sore throat, gargling, etc., were false and fraudulent. (Notice of Judgment 19030, issued July, 1932.)

Kojene and Kojenol.—Kojene Products Corporation, Buffalo, N. Y. Composition: Kojenol-oxyquinoline sulphate (1.9 gm. per hundred milliliters), resinous material and

water. Kojene-oxyquinoline sulphate (0.7 gm. per hundred milliliters), water, methyl salicylate. Claims for use as antiseptic in the mouth and throat were false and misleading. (Notices of Judgment 19032, issued July, 1932; 19038, issued July, 1932; 19187, issued October, 1932.)

Dr. Lee's Preventive Dentifrice.—Dr. Ray O. Lee Laboratories, Kansas City, Mo. Composition: sodium perborate, talc, calcium carbonate, and methyl salicylate. Claims for preventing pyorrhea, were false and fraudulent. (Notice of Judgment 19033, issued July, 1932.)

Lav-O-Din.—Western Chemical Co. (Inc.), Hutchinson, Minn. Composition: potassium iodide, sodium chloride, carbonate, alcohol and water, flavored with cinnamon oil. Claims as an iodine antiseptic for pyorrhea, trench mouth, bleeding gums, etc., were false and fraudulent. (Notice of Judgment 19040, issued July, 1932.)

Norwich Dental Cream.—Norwich Pharmacal Co., Norwich, N. Y. Composition: soap, calcium carbonate, borate, emetine, alcohol (13 per cent by weight), and water flavored with peppermint oil. Claims for the preservation of teeth, prevention of pyorrhea, etc., were false and fraudulent. (Notice of Judgment 19041, issued July, 1932.)

Dr. Smiley's Pyrozene.—Smiley Medicine Co., Augusta, Kan. Composition: tannin, sodium chloride and water. Claims for use in pyorrhea, etc., were false and fraudulent. (Notice of Judgment 19050, issued July, 1932.)

Bafaline Dental Cream.—Bafaline Laboratories (Inc.), Manchester, N. H. Composition: calcium carbonate, glycerin, magnesium hydroxide, sodium pyroborate, sodium benzoate, soap and flavoring materials. Claims for antiseptic qualities and prevention of pyorrhea were false, misleading and fraudulent. (Notice of Judgment 19065, issued July, 1932.)

Duncan's Ozon.—Duncan Chemical Co., St. Louis, Mo. Composition: pine oil. Claims for use in sore mouth, Riggs disease, and pyorrhea were false and fraudulent. (Notice of Judgment 19156, issued October, 1932.)

Phenol Sodique.—Hance Brothers & White (Inc.), Philadelphia, Pa. Composition: phenol, an alkali and water. Claims as a general antiseptic were false, misleading and fraudulent. (Notice of Judgment 19156, issued October, 1932.)

Dunlop Pyorrhea Paste.—Dunlop Pyorrhea Machine Manufacturing Co., St. Paul, Minn. Composition: boric acid, glycerin, peppermint oil and alcohol. Claims as an antiseptic pyorrhea paste, etc., were false and fraudulent. (Notices of Judgment 19161, issued October, 1932; 19158, issued October, 1932.)

Klen-Dent.—Klen Dent Co. (Inc.), Eureka Springs, Ark. Composition: sodium perborate, magnesium oxide, magnesium peroxide, soap, methyl salicylate and fatty oil. Claims for preventing pyorrhea, preventing decay, etc., were false and fraudulent. (Notice of Judgment 19164, issued October, 1932.)

Spearmint Tooth Paste.—W. W. Wrigley Sales Co., Atlantic City, N. J. Composition: calcium carbonate, soap, glycerin and spearmint oil. Claims as a preventive against pyorrhea, fermentation, destruction of tartar, etc., were false and fraudulent. (Notice of Judgment 19165, issued October, 1932.)

Pyradium.—Radium Remedies Co., Minneapolis, Minn. Composition: zinc sulphate, sodium chloride, boric acid, radium (1.68 millimicrograms per milliliter), glycerin, water, peppermint oil, colored green. Claims for use in pyorrhea, trench mouth, etc., were false and fraudulent. (Notice of Judgment 19166, issued October, 1932.)

Pyorrhine Tooth Powder, No. 1 and No. 2.—Pyorrhine Chemical Co., Oakland, California. Composition: No. 1—aluminum, calcium, and magnesium compounds, carbonate, phosphate and sulphate and sugar, flavored with methyl salicylate; No. 2—compounds of aluminum, calcium and magnesium, carbonate, phosphate and sulphate, soap and sugar, flavored with methyl salicylate. Claims for preventing pyorrhea, healing and

hardening gums, etc., were false and fraudulent. (Notice of Judgment 19180, issued October, 1932.)

Glyco-tan-phene.—Hagedon Chemical Co., Indianapolis, Ind. Composition: phenol, tannin, menthol, glycerin and water, colored brown. Claims as an antiseptic for pyorrhea, sore and inflamed conditions of the throat and mouth, etc., were false and fraudulent. (Notice of Judgment 19360, issued November, 1932.)

San-Cura Ointment.—Thompson Medical Co., Titusville, Pa. Composition: petrolatum base, phenol and camphor. Claims for toothache, etc., were false and fraudulent. (Notice of Judgment 19370, issued November, 1932.)

Morphine sulphate, caffeine, sodium benzoate, iron arsenite, nitroglycerin, strychnine sulphate, cocain hydrochloride, ergot, procaine and epinephrine carpules.—Cook Laboratories, Chicago, Ill. Claims concerning the stated amount of the respective product in each carpule were false and fraudulent. (Notice of Judgment 19375, issued November, 1932.)

Cal-So-Dent.—Calsodent Co. (Inc.), New York City. Composition: sodium chloride (95.8 per cent), sodium bicarbonate, volatile oils including menthol, eucalyptol and thymol, and saccharin colored with red dye. Claims for use in pyorrhea, infection, etc., were false and fraudulent. (Notice of Judgment 19386, issued November, 1932.)

Oxylene Paste and Oxylene Liquid.—Hance Bros. & White (Inc.), Philadelphia, Pa. Composition: Oxylene Paste: calcium carbonate, clay, powdered ipecac, volatile oils, including menthol, clove oil and anise oil, a gum, glycerin, sugar and water; Oxylene Liquid: coal-tar oil, capsicum oleoresin, phenols including guaiacol and methyl salicylate, other volatile oils, including clove oil, sassafras oil, and turpentine oil, ether, alcohol (by volume 20.2 per cent) and water. Claims regarding pyorrhea and diseases of the gums were false and fraudulent. (Notice of Judgment 19453, issued December, 1932.)

Mackie's Pine Oil.—Mackie's Pine Oil Specialty Co. (Inc.), Covington, La. Composition: coniferous oil. Claims for the germicidal properties were false and misleading, and claims for toothache, local anesthetic, etc., were false and fraudulent. (Notice of Judgment 19455, issued December, 1932.)

ZePyrol.—McKesson-Potts Drug Co., Wichita, Kan. Composition: zinc chloride and glycerin, alcohol, emetine, water, flavored with cinnamon and colored with red dye. Claims for antiseptic properties in pyorrhea, etc., were false and fraudulent. (Notice of Judgment 19461, issued December, 1932.)

Viavi Liquid and Viavi Liquid and Cerate.—Viavi Co., San Francisco, Calif. Composition: Viavi Liquid—glycerin, extracts of plant drugs, including hydrastis and water. Viavi Liquid with Cerate—composition as above, and ointment consisting of tannin, berberine and hydrastine in a base of theobroma oil and a petroleum product. Claims for catarrhal conditions of nose, throat, etc., were false and fraudulent. (Notice of Judgment 19466, issued December, 1932.)

Dr. Simmons Four-Fold Salve.—Wm. R. Warner Co., St. Louis, Mo. Composition: volatile oils (10 per cent), including camphor, menthol and methyl salicylate, incorporated in petroleum (90 per cent). Claims in connection with toothache, sore gums, etc., were false and fraudulent. (Notice of Judgment 19467, issued December, 1932.)

Lillibeck's Antiseptic Aseptine.—McKesson Van Vleet Corporation, Jackson, Miss., and Vicksburg Chemical Co., Vicksburg, Miss. Composition: volatile oils, including menthol and peppermint oil, traces of tannin and ethyl nitrite, alcohol and water. Claims for sore throat, neuralgia, etc., were false and fraudulent. (Notice of Judgment 19485, issued December, 1932.)

Pyro-Sana Tooth Paste.—Alhosan Chemical Co., St. Louis, Mo. Composition: calcium carbonate, glycerin and a small proportion of creosote. Claims for preventing pyorrhea, receding gums, etc., were false and fraudulent. (Notice of Judgment 19502, issued December, 1932.)

Nitro-Methol Aseptic.—Denver Mud Chemical Co., Kansas City, Mo. Composition: ethyl nitrite (1 gm. per hundred milliliters), alcohol (by volume 58 per cent), and small proportions of aldehydes and volatile oils, including menthol and thymol. Claims for sore gums, pyorrhea, etc., were false and fraudulent. (Notice of Judgment 19512, issued December, 1932.)

ONE VIEW OF THE COUNCIL

Accepted Dental Remedies modestly symbolizes the beginning of a new dental epoch. When, in 1928, the American Dental Association established its Bureau of Chemistry and in 1930 its Council on Dental Therapeutics—a disinterested group of eminent representatives of dentistry and allied sciences—the Association took two of the most important steps forward in the history of organized dentistry. When, in 1934, the Council on Dental Therapeutics issued its Accepted Dental Remedies, the Council gave useful form to one of the most constructive influences for the advancement of oral health-service. The Council has been actively exposing the humbug in the advertised claims for many "remedial" agents that dentists have been persuaded by ignorant or unprincipled commercialists to use. But, having formulated scientific and practical criteria upon which judicially and fearlessly to evaluate advertised claims for therapeutic products, the Council has also compiled the properties of remedies that are acceptable and which dentists can use with understanding, confidence and self-respect. The information in Accepted Dental Remedies —concisely stated, logically arranged, and conveniently accessible—is indispensable, professionally and economically, in every dental practice. From it, the dentist may learn many practical things—that, for example, for fifty cents, he can obtain from a druggist the zinc oxide for which, as pulp-capping materials under proprietary names, he has been paying as much as $72.00. Money can be saved, and disappointments or distresses avoided, when new advertising material is read or received, by ascertaining whether "the product" is listed in Accepted Dental Remedies, or, if not, whether it has lately been approved by the Council; and if neither—by buying none of it. Accepted Dental Remedies is the first comprehensive, authoritative, and disinterested compilation of its kind. "If you find it in Accepted Dental Remedies, you may depend upon what is said for it"—and "If you don't find it in Accepted Dental Remedies, don't use it"—will become, we believe, two generally accepted dental reliances.

Accepted Dental Remedies will give to pharmacology and dental therapeutics, as taught in dental schools, a new rigor and pertinence. The spirit of fair and desirable skepticism pervading the rulings of the Council, as shown in the book, will be infused into dentists generally, who will use fewer drugs more critically and intelligently, with cumulative benefit to themselves and their patients—and with increasing profit to those who produce acceptable proprietary remedies honestly, and advertise them honorably. Pharmacists will be stimulated to cooperate more intimately with the dental profession in the preparation and sale of useful products.—William J. Gies in *J. Am. Coll. Dentists*, October, 1934.

BUREAU OF PUBLIC RELATIONS

THE HOUSE THAT SHACKS BUILT

By G. G. BELL, D.D.S., Ashland, Ky.

DURING the "recent" depression, when accounts were frozen and one could not collect enough to pay the postage on mailing out statements, and many idle men tramped the streets in vain search of work, I, like many others, found it impossible to collect for services that had been rendered or to keep busy even part of the time. I tried turning my idle moments to writing, with the result that my desk soon filled with manuscripts and the stamp problem became a burden rather than a source of income.

I tried itinerant practice into the surrounding hill country, hoping that the rural district might afford some work for which I would receive chickens, eggs and other household commodities in exchange for my services, even if I did not receive any money. But lo! the depression had preceded me. It would have been criminal for me to accept from the meager supply of the country folk any of their produce in exchange for my service. I extracted many teeth and relieved much suffering, my reward being only the knowledge that I had been on an errand of mercy. It proved an outing and also showed that the pall of want was no respecter of place or person. There was no market for money crops, and the elements had stinted the supply of garden vegetables and fowls for food. I returned to my office undaunted, but decided to reverse the axiom: "Satan finds some mischief still for idle hands to do," to "Patience finds some work still for idle hands to do."

A steel mill operating in our town had purchased some property upon which stood an old nail mill which had weathered the panics of the past seventy-five years, but which had finally been shut down and was to be dismantled. Hearing of this, I consulted the proper official of the company and, for a nominal sum, I was to receive the old lumber and brick, the iron parts being taken back to the company's plant for remelting. Instead of cash as the company's payment, I was to furnish labor to clean up the grounds after the building was wrecked. I went over my books, selecting from my accounts the names of men who had been employed doing ordinary labor. I called upon them personally after my day at the office and proposed to them that, while they were not employed upon some Federal project, they go to this old building and clean up the lumber by removing nails and sweeping the lumber and stacking it in piles, assorting the lengths that could be easily loaded upon trucks. The brick foundation and walls were to be torn down and the mortar removed from the bricks that they might be used again.

My object at first was to dispose of all the salvage and thus convert my frozen assets into liquid ones. But the texture of the bricks, aged for three quarters of a century, appealed to me. I decided they might make a residence that would be attractive. The stone furnace that had

been used to heat the strips of iron to be fashioned into nails had been beautifully colored through its long life with iron rust and heat. These stones, it seemed to me, would blend beautifully with the brick in making a foundation and also a garden wall. The weather and heat had removed all marks of the stone mason's chisel, and as these stones lay where they had served for years as the wall of the down the old wall, many pieces of angle iron that I knew could be put to practical use, being placed over windows and doorways to support jack-arches.

I found that, aside from having sufficient material from which to build a house, I would have many thousands of brick to trade or sell, as well as a goodly supply of used lumber. Having the makings of the house, all that I required was

Fig. 1.—The house. The windows are of as many shapes and designs as the number of windows themselves.

furnace, they looked as if some one had tried to place them in a mosaic—to reproduce a small section of an October woodland. Great grindstones a foot in thickness and 8 feet across that had been used to sharpen the bits of the nail machines, I pictured as serving for doorsteps and porch floors. I found, too, as I tore sufficient trading around to convert the labor of my patients into the structure.

I found my patients very willing to work, and after the dismantling started, many other people came to me who were in need of dental service and worked a sufficient time to have their mouths put in order. Young school boys worked on

Saturdays that they might have their teeth filled, as well as the teeth of their sisters. Occasionally, some young man would work that his sweetheart might have the required dental service. Old men worked when the weather would permit that they might have dentures. One woman, who of course could do no manual labor, proved very valuable in keeping records of the men's labor and hunting up prospective sales for my sal-

Fig. 2.—The roof and the gate. The roof of clapboards looks as if the weather had turned and twisted them. The gate of hand-hewn pickets swings on the stone posts.

vage. For my new patients, I worked on Sunday, after supper and on days when the rain or bad weather prevented outside work. Men who had been coming to my office to have toothache relieved or teeth extracted with no intent to pay me, I now required to do some labor in exchange. This relieved me of a class of patients who were mere parasites, and gave me instead a sturdy, ambitious class of persons who were willing to pay in labor for any service they might receive.

I allowed $3 per thousand for cleaning brick, and a like amount per thousand feet for cleaning lumber. At this rate, the average daily income was about $2.50.

My first exchange of this old material was for a garage and flooring of a parking lot, requiring 40,000 bricks and 20,000 feet of lumber. The owner of the garage agreed to pay me, not in cash, but in gasoline, oil, mechanical work or supplies of any kind.

While the work of salvage was going on, I had hunted up a plot of ground in one of the subdivisions that could be had on very easy terms. As a partial payment, the owners were to use lumber and bricks to repair houses they owned which had deteriorated from lack of occupancy. My lot was a beautiful plot of ground upon which grew three poplar trees and the same number of beeches, the back part being covered with sourwood, persimmon, sarvice and gum. Already I could picture my house nestled among these trees, away from the noise of the city and the clamor for existence.

My second exchange: To a man who carried on a trucking business I passed credit to the garage maker; while the trucking man agreed to accept oil and gasoline for the service of hauling brick, lumber and stone to my new house site. A lumber dealer agreed to a similar passing of credit for the furnishing of such new material as I might need in my building.

A new set of teeth adorns the mouth of the man who did my plastering. The other members of his family too had their mouths put in order. To a hillsman, I traded a set of teeth for the clapboard, or "rived" shingles for my house, he

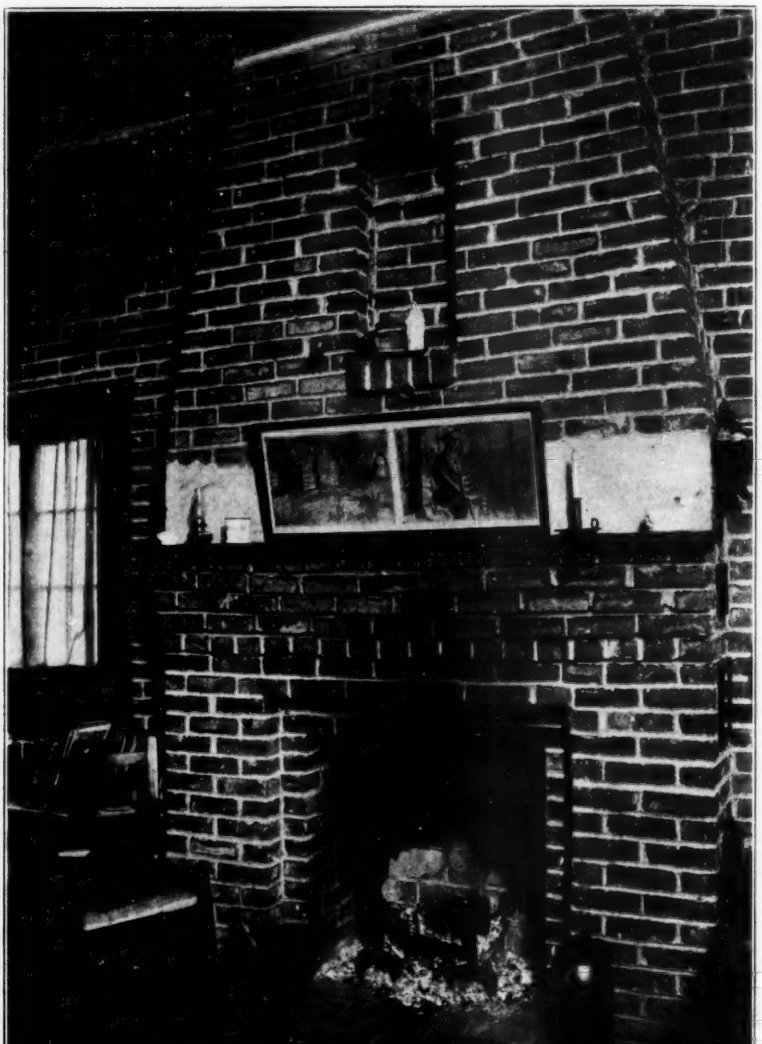


Fig. 3.—The house that "shacks" built: the study fireplace.

"riving" them by hand. My next exchange of material was to a groceryman who built a garage to house his trucks, with the understanding that I was to take

my pay in groceries. I passed this credit to a bricklayer, a carpenter and a plumber. And, not being unselfish, I dealt a goodly portion of it out myself. The money that I had been using for groceries, I applied on my own indebtedness, probably very much to the surprise of some of my creditors.

Old buildings throughout the city were being razed to remove fire hazards, or just because they were unsightly. On these, I furnished labor and for my compensation received old mantels, stone, window sills, windows, window frames, doors, hardware, locks, bolts, and one old ring knocker, made of iron.

Soon my lot was stacked with piles of stone, brick, lumber and finishing materials. It appeared as a chaotic mass in which one could be lost and suggested more the work of a cyclone than material from which a house could be built.

Having decided to build a house of the English type, I made the foundation from the old colored stones from the heating furnace. I discarded formality of bond in laying them, and as they were laid with various shapes and sizes, it looked as if the stones had been stacked up to get them out of the way rather than to answer a utilitarian purpose. The bricks started upon this foundation were laid in flemish bond, the courses not reaching a true level until the work arrived at the second story. The windows that I had taken from various old buildings were of as many shapes and designs as the number of windows themselves. The roof was of clapboards, or "rived" boards as they are called here. Their arrangement was such that they looked as if the weather had turned and twisted them into an unrhythmic arrangement. The roof was painted a deep green. The chimneys were mounted with chimney pots that had been removed from old buildings where owners had discarded coal as fuel and gas now burned. These chimney pots had long since served their purpose in one residence and had been taken to a new home that they might make a fire burn more merrily.

The fireplaces, three in number, were finished both hearth and breast with bricks that had been removed from a sidewalk. They were scrubbed and cleaned, but look now as if they had been in their present position for a lifetime. One room, which we shall call the study, has a fireplace going up into the mansard, the ceiling alone being plastered. The walls are finished as is the fireplace, with the old sidewalk brick. A mantlepiece and a five-foot shelf for books are made of the same brick. The windows are all casement. The internal and external doors are of many designs and sizes. The huge grindstones serve one for the front door step, the other for the floor of the back stoop. The walls are 12 inches thick, thus excluding dampness and moisture and adding warmth in the winter and coolness in the summer. The shrubbery around the house has not been disturbed. It is in its virgin stage.

Raspberry and blackberry bushes, wild rose and sweet briar festoon the garden wall and house. An old lamp mounted upon a lamp post taken from the city streets, and which served many years ago when a village lamplighter made his rounds, now lights one's feet over the flagstones that are laid from rocks taken from creek bottoms, giving an English air to the surroundings.

The stairway leading to the second floor is made of heavy oak that Nature had stained in its former abode.

Over the high paneled study door is a stoop with a "rived" oak shingle roof. Its floor is formed by one of the great stones from the mill. At either side are high backed stone benches. Across the front and meeting the stone posts is a

high gate of hand hewn pickets. The gate swings on the stone posts. On one of these hangs the iron knocker—the iron ring, calling to mind the days of old England—merrie England, when the like of Lord Thomas rode forth on his steed to bid Fair Elender to his wedding. Beside such a gate, Lord Thomas might have "lighted down"

—and tingled so loud on the ring—
So loud-ly tingled and call—
And none more ready than Fair Elender
For to rise and welcome him in

Stone seats under the stairway made from old door sills invite the weary traveler to pause and rest.

Out of chaos and piles of brick and stone and wood, a house is built!

From labor of long days past, a house has been built. The time that would have hung heavily on my hands has been spent in fixing up mouths that would have gone to ruin through lack of funds. Men have paid their bills that were of long standing through labor that they seemed to enjoy as much as I.

Young boys and girls have had their teeth filled. Old men and women have new sets of teeth. Sons have worked out sets of teeth for parents. Old men not only worked out sets of teeth for themselves, but their families have had their dental wants taken care of as well. Two painters who had long been edentulous now have teeth of porcelain on which to chew their wholesome food. Bright happy faces with smiles that show no decaying teeth reward me for my efforts. It has been a labor of love to turn idle moments into productive work. The noon hour and early morning hours were spent in supervision of the workmen.

Trading as our forefathers did, with no money, proved interesting as well as profitable.

Aside from canceling many old debts, my records show that I inserted nearly 600 fillings. I made forty sets of teeth, and more than 500 teeth were extracted. In addition, 100 mouths were put in a sanitary condition by cleaning and prophylaxis.

The home in which I had lived was incumbered. The payments were in arrears. An accumulation of debts had been hanging over me and the dearth of business had added additional worries.

The diversion of house wrecking and home building proved a blessing.

Each old stone and bit of iron mongery that I had found at the old mill I worked into my new house. My new plans were to sacrifice the home in which I had lived for years, and let it be taken over by the lien holders.

I made one mistake, but it was in my favor: I made the new house too attractive. I have sold it, thus saving my old home in which I expect to spend my remaining days, days that I had counted on spending in front of my open fire will now have to be spent in my office planning on other things that will aid me in completely whipping the depression.

The bricks of sidewalks that weary feet had trod in search of jobs that were never found have been converted into hearths and study walls. Stones that were left to be covered with moss and lichen have been converted into foundations and garden walls. Chimney pots that once served as receptacles for refuse serve now as mountings for chimneys that will waft forth pale blue smoke skyward—smoke from the remainder of the old wood and timber. Warm hearth fires will drive away the chill of winter nights. Flagstones that centuries of purling waters have smoothed and carved now serve as walks from house to street and from house to garden. The finished structure looks as if it had stood for a century or as if it had been trans-

planted from some old English village on the Thames.

Its new owner will, no doubt, have many hours of comfort and a great deal of satisfaction within its walls. The new owner (they do say she's something of a dreamer, a make-believer) might, if she is so minded, fashion many a good tale within its walls on winter evenings before the cheery hearth fire; tales of Furnace Master, lords of industry, stone mason, mill worker; tales even of lords and ladies, what with the "iron ring at the gate." Who can tell?

But tales or no tales—English cottage or no—there it stands. For lack of a better name, I have always called it "the house that shacks built."

THE CONTROL AND ARREST OF DENTAL CARIES: AN INSTITUTIONAL STUDY*

By C. L. DRAIN, D.D.S., and J. D. BOYD, M.D., Iowa City, Iowa

ON previous occasions, arrest and control of dental caries in children has been reported.[1] This work has been based on the premise that the nutrition of the child with active caries was in some respects inadequate. This premise has been strengthened by the facts that arrest of dental caries does occur when the diet is made complete and that children whose nutrition is maintained at optimal levels do not develop cavities. These views, which have been supported by other workers,[2] seem to indicate that if the growth, development and health of the child are maintained at the optimum by insuring adequate nutrition, dental caries will not occur or will be arrested if already present.

In the past, we have included as a dietary basis certain essentials which are well known. In the study at hand, our purpose was to determine, if possible, the adequacy of a low-cost diet in arresting or controlling caries. To accomplish this, children in several state institutions have been examined, and the condition of the teeth has been correlated with the type of food employed. This report deals with one of these surveys, in which about 10 per cent of the children of an orphanage were examined on at least two occasions, with a lapse of about eight months between examinations. The ages ranged from 4 to 12 years. As a sequel to this study, a small group of children were studied in great detail under hospital regimen, with determinations of retention of calcium, phosphorus and nitrogen.

PROCEDURE

Since our purpose was to evaluate the effectiveness of the institutional diet with respect to tooth protection, no changes were made in the food offered to the children. A group approximating 10 per cent

*From the College of Dentistry and Department of Pediatrics, College of Medicine, State University of Iowa.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 7, 1934.

1. Boyd, J. D., and Drain, C. L.: J.A.M.A., 90:1867 (June 9) 1928; Dietary Control of Caries, J.A.D.A., 18:738 (April) 1930.

2. McBeath, E. C.: J. D. Res., 12:723 (Oct.) 1932. Howe, P. R.; White, Ruth L., and Rabine, Millon: Am. J. Dis. Child., 46:1045 (Nov.) 1933.

of the orphanage population were chosen at random. The only restrictions exercised in choosing the children were that they should be between 4 and 12 years and that they should have been under the institutional regimen at least six months.

In order to obtain an accurate check on the food intake, the children studied were segregated at a single table in the dining hall, where they were served by one of the attendants. During six weeks of the study, a trained worker from our department of nutrition was in residence at the orphanage in order that we might obtain an accurate evaluation of the average food intake of the individuals in the group. Dental examinations were made at the beginning of the study, in July, 1931, and at the close, in March, 1932.

As the regular routine of the children did not include compulsory mouth care, the oral hygiene was that of any unselected group of similar size and environment.

The metabolic studies were made in the metabolism wards of the Pediatric Department of the College of Medicine, the data being provided by Dr. Genevieve Stearns and her staff. The procedure used in this phase of the problem has been reviewed elsewhere.[3]

RESULTS

In this group of fifty-three orphanage children, which represented approximately 10 per cent of the entire population, it was found in the initial examination that the average number of cavities per child was 2.4. This same group was examined eight months later, when the average number of cavities was found to be 2.1. The reduction can be accounted for by the fact that several deciduous teeth were shed in the interim. No dental attention of any kind was given to any of the children during the experiment.

Employing the probing method as a means of evaluating the degree of carious activity, we determined that nineteen, or 37 per cent of the number, presented an improved condition, twenty-three, or 43 per cent, were essentially the same, including sixteen who had no cavities on either examination, and eleven, or 20 per cent, had additional cavities or increased activity of the already existing caries. Adding together the group of nineteen whose mouths presented an improved condition and the twenty-three whose condition was stationary, we have forty-two, or about 80 per cent of the group. We may say, therefore, that the regimen carried out at the orhpanage was sufficient to control dental caries in approximately 80 per cent of the group.

Of the eleven presenting additional cavities or increased carious activity, five were studied further in an attempt to determine the reason for lack of control and, if possible, establish a regimen which would protect the teeth.

The metabolism studies made included an estimate of the daily retention of calcium, phosphorus and nitrogen, expressed in terms of the body weight of the child, who received throughout the period of study as well as during a suitable foreperiod a diet containing liberal amounts of each of these dietary essentials in easily assimilable forms. The retention at the time of admission was compared with that noted subsequently at repeated observations separated by intervals of several weeks. The dental progress was correlated with these chemical studies. It was found that the retention of these children at the first periods of observation was decidedly lower than in the subsequent periods, at which time their caries had become less active or had been completely inactivated.

3. Boyd, J. D.; Drain, C. L., and Stearns, Genevieve: J. Biol. Chem., 103:327 (Dec.) 1933.

As a control, two of the orphanage children with no caries were studied under a similar regimen. These children showed no noteworthy differences between the initial and the terminal metabolic observations.

From these data, together with those offered in an earlier study of the relation between metabolic processes and susceptibility to decay, we hold the view that a real relationship exists betwen the adequacy of retention of minerals and the degree of resistance to decay of teeth. With careful supervision of the diet, the efficiency of retention increases, and, parallel with this, the tendency to caries is diminished or disappears. An individual variation in metabolic efficiency evidently exists, explaining, in part at least, the fact that under similar diets of borderline inadequacy, certain children are protected from caries while others are not.

COMMENT

The ability of institutional diets to control dental caries has been previously reported,[4] and this study serves to fortify that work. Our primary interest was to determine the effectiveness of a low-cost diet in arresting and controlling dental caries. The food allowance in the institution studied was 8 cents per meal per child not including milk, butter and eggs. Including this cost, the allowance increased to 10 cents per meal. An analysis of the food offered the children during the observational period indicates that fancy foods and knickknacks were not used, that the cheaper rougher vegetables were used extensively and that, in general, the diet was made up of simple foods. In addition, the calcium and phosphorus intake was fairly adequate; the vitamin D in the diet was low, and the protein somewhat lower than desirable. The carbohydrate in the diet included the usual cereals, potatoes, etc., together with jelly, syrup, simple desserts and 20 gm. of refined sugar.

It is interesting to observe that, in the orphanage, food is not eaten between meals, and that soon after children come to the institution, they are taught to clear their plates of all food. It is striking to see plates, more than 500 of them, cleaned of all food, the upturned milk cup placed in the center. This is the custom at the end of every meal.

The ability of this low-cost diet to control caries in 80 per cent of the children might be taken as evidence that, for the prevention of caries, it is not always obligatory to follow the more complete nutritional regimen recommended in the previously published reports of the Iowa studies.[5] Orphanage conditions do not obtain in the home. The ingestion of the diet is not regularly enforced in the private home, and, moreover, the nutritional program in a majority of American homes is less adequate in its essentials than that supplied in this orphanage. Under average home conditions of rather lax diet control, the incidence of caries is much higher than in the orphanage group. With strict and adequate diet control, the incidence is far lower. The fact that the best control is obtained with the best diet, and that resistance of the teeth is only one manifestation of adequacy of body processes as a whole, justifies the insistence that dietary standards be kept as high as the socio-economic status of the group will permit, and that when diet economies are practiced, the foods ingested be chosen with care and insight as to their content of the protective factors.

SUMMARY AND CONCLUSIONS

A study of a group of orphanage children averaging 7.3 years of age, and

4. Bunting, R. W., et al.: Am. J. Dis. Child., 40:536 (Sept.) 1930. Footnote 2, first reference.

5. Footnote 1, first reference.

ranging from 4 to 12, were studied from a dental and nutritional standpoint to determine the ability of a low-cost diet to control and arrest dental caries. As a part of the problem, five of the group whose dental condition was worse after eight months' time were used as subjects for intensive metabolic study.

We may conclude from the foregoing:

1. The nutritional program of the institution was sufficient to insure tooth protection to 80 per cent of the children.

2. The 20 per cent whose dental condition was worse at the end of the observation period were unable to utilize a sufficient amount of the nutritional essentials offered by the institutional diet for adequate tooth protection.

A CONSTRUCTIVE PROGRAM FOR DENTAL HEALTH*

MANY of us, because we take care of our own teeth and our children's teeth are apt to think that the rest of the world cares for their teeth and the teeth of their progeny. As a matter of fact, statistics show that many of our neighbors do nothing of the sort.

We Americans have always taken a pardonable pride in our national health. It took the World War and the health records resulting from the examination of thousands of our young men to disprove some of our inflated ideas regarding our physical fitness. One of the most startling facts uncovered at that time was that in America, the birthplace and home of scientific dentistry, dental defects ranked second among the causes of rejection for army service. It was not some vitally serious physical disability such as blindness or stomach ulcers, nor was it some dread disease such as tuberculosis or diabetes that topped the statistical column of physical unpreparedness and excluded thousands of men from military service; it was dental defects—bad teeth and wrecked mouths. It was cavities that men couldn't spare the time to have filled, infections which men felt were too minor to waste valuable time on, but which the army recruiting officers knew from previous practical experience would soon seriously impair fighting efficiency. This condition prevailed, in spite of the warnings and advice of health officials, physicians, dentists, magazine and newspaper health articles. True, the radio had not as yet been developed as a means of disseminating knowledge. Since the War, this educational avenue has been added to those already mentioned. Not a day goes by but one hears some program, either commercial or educational, in which the care of the teeth is mentioned. However, in spite of this tremendous amount of educational publicity, dental defects, like the poor, are always with us.

Let us, for example, consider some of the statistics gleaned from the physical examination of school children in various parts of the country. One report from New York City discloses that 62 per cent of 266,426 children examined had defective teeth. This examination was made by physicians without the aid of any special instruments. Had it been made by dentists equipped with mouth mirrors and explorers, the figures would have been much higher. A few years ago, Cleveland reports indicated an average of 5.6 cavities per child. Andover, Mass., reported that 96.9 per cent of their school children had defective teeth. Chicago reports that 96.4 per cent of their school children

*Radio talk to parents.

have defective teeth, with an average of 4.6 cavities per child. St. Louis reports that 95 per cent of their children of school age have one or more defective teeth. These deplorable dental conditions are not entirely confined to the cities mentioned. Similar conditions prevail in practically every community throughout the length and breadth of this country. Conservatively speaking, between 80 and 96 per cent of American children of school age have infected teeth. If these statistics related to any other illness or ailment, American mothers or fathers would be up in arms; newspaper headlines would scream the condition to their subscribers, and society would bend every effort to correct the evil.

Bad mouth conditions, by opening the doors to other infections, by producing infections themselves and by undermining the health and resistance of the individual, are far more serious than is commonly supposed. No community can have four-fifths of its citizens affected without being seriously injured—economically, intellectually, physically and morally. Any intelligent person can readily understand how defective and infective teeth can become a community liability. If four-fifths or more of our citizens have infected mouths, and if, as medical authorities and research workers agree, infected mouths cause a certain percentage of physical illness, dental defects at once become a health liability. Illness adversely affects individual and community income. Naturally, the more a community is incapacitated by illness, the greater the community income is affected. Any disease which, either by its virulence or by its prevalence, contributes to community unfitness, lessens community prosperity. Every reasoning, intelligent individual can readily understand how dental defects can adversely affect the health and income of individuals and groups. It may be harder to understand how defective teeth can affect individual and community intellectuality and morals.

No child can successfully perform his school work if he is suffering from an acute toothache. Any man or woman in this audience who has ever suffered from such a condition will readily realize the impossibility of concentration until the pain is relieved. Children suffering from five or six or, as in many instances, twelve or fourteen cavities, cannot be expected to function normally. Nor is acute toothache the only offender in this respect. Many times, the bacteria and the poisons generated in and about abscessed teeth, while they may not produce acute pain, do reduce the child's physical fitness, lower his resistance and produce toxic conditions that render him unfit to carry on his school work. The curriculum of the modern American school is so intense that the handicapped child finds it extremely difficult to keep abreast of his class. We can readily understand how, consequently, the loss of several days' or several weeks' time, because of aching or abscessed teeth, can cause mental retardation. Likewise, we can readily understand how, in many instances, children can attend school regularly, yet their nervous systems and their mental processes can be so seriously impaired by toxic conditions produced by infected teeth that they are unable to do their school work.

Much of the mental retardation encountered among school children is directly attributable to poor health. Some of the poor health found among school children is attributable to poor teeth. Reports received from various communities indicate that the adoption of a mouth hygiene program in the schools has definitely reduced the number of repeaters in the grades. Atlanta, Ga., reports that the installation of a system of dental inspec-

tion and correction of dental defects in one of their schools in one year reduced the number of absences 1,200 days. On the basis of the 1926 figures, the average annual cost of educating a child in the United States is about $82. It costs as much to conduct a child over the ground the second time as it does the first time. Were we able to secure reliable statistics regarding the average number repeating because of dental decay, we would be amazed at the tremendous cost to the community. In the absence of such figures, the following statement is quoted from Mr. Sutton, superintendent of the schools of Atlanta:

> You will note that our intensive program for dental and health education began about six years ago. . . . Seven years ago, our average per cent of failures in six elementary grades was 12.9 per cent. Today (June, 1928), our percentage of failures in the same grades will not exceed 5.5 per cent. In other words, we have reduced our retardation certainly one half. This is very remarkable in view of the fact that during the last few years we have been forced, on account of lack of money, to increase the number of children in each class. . . . The cost of educating a child in the Atlanta Public Schools for the elementary grades is something over $60 and for the high schools about $104 per year. I believe, conservatively speaking, that our health program in Atlanta is saving in the neighborhood of $200,000 to $250,000 per year to the school system, and the amount of savings to the individual child in better work and increased efficiency and more rapid transition from grade to grade can never be estimated.

Besides the saving in dollars resulting from a definite and comprehensive health program, consider the saving in terms of the child's self-respect, the parents' pride and the teacher's time and patience.

Children, of course, are but a small, although very important, part of the community. Employers know how much time is lost in sick leave. They also know how much productive time is lost by employes' coming to work too sick to accomplish a normal output. Rheumatism, headache, physical debility, kidney, heart and digestional disorders directly or indirectly due to infected teeth lower production and waste employes' time and employers' money.

This is the economic aspect, but, in spite of accusations to the contrary, we Americans do not reckon such matters in dollars and cents alone. Very few of us are willing to condemn our fellowman, much less our children, to suffering and failure provided the remedy for such conditions is at hand. Undoubtedly, much preventable suffering and failure is attributable to dental defects. The strongest constitution cannot bear up indefinitely against the inroads of infection that are found in some mouths. No one will ever be able to estimate accurately the number of children who have succumbed to disease because their systems had been previously weakened by dental infections; nor will we ever be able to estimate accurately the thousands of adults whose incompetence and antisocial concepts and actions were caused by dental foci of infection. It is much too late to attempt an adequate dental preventive program for adults. We can and should, of course, remove every vestige of infection from our mouths in order to prevent any further systemic involvement. However, our chief effort must be focused on the children—and the very little children at that.

A truly preventive dental program must be directed at and for the school and preschool child. If we wait until the child becomes old enough to read, think and reason for himself, or until he can attend lectures and be motivated thereby to care for his teeth, much of the damage of dental disease will have already taken

place. That is why preventive dentistry for the younger children is so important. To recall the old story of the hole in the dyke, if we stop the trouble at the beginning, while the defect is small, little damage is done. Procrastination produces a situation which it is almost impossible to repair. If we neglect the children's teeth until they reach adult age, their mouths will become as our mouths are today, and all the dentists in the United States working twenty-four hours a day could not correct their dental deficiencies.

Unfortunately, we do not know definitely the causes of dental decay, but we do know certain other facts regarding this disease which should prod us into action. We know not only that dental decay is serious in itself, but that it can and often does cause serious systemic disease such as heart, kidney, joint and many other kinds of infection. We know that a very large percentage of our population is suffering from dental infection. Surveys have shown us conclusively that between 80 and 96 per cent of our school children are dentally infected. We know definitely from programs which have been in operation for several years in other cities that a very large percentage of dental decay in children can be prevented. We know that if dental decay is prevented in childhood, adults will have but little decay, and, finally, we know that, by preventing serious dental decay, abscesses and other mouth infection, we automatically prevent the systemic infection which these defective teeth might cause.

The simplest and most direct method of preventing dental decay in our community is to establish a well-organized dental program in the schools. This program should be supervised by a competent person, one who understands and can direct the different phases of the work. The program should consist of three phases or divisions: education, systematic examination and reparative or preventive care. The dental educational program can easily be worked into the present school curriculum. The educational material should be graduated to meet the needs of, and be understood by, the different age groups. The educational program should consist of lectures, dental health lessons accompanied occasionally, or when advisable, by steriopticon slides, moving pictures and other visual material. These lessons should cover quite definitely such subjects as diet and its relation to dental health; the value of exercise to the teeth and jaws; mouth hygiene, and the necessity of early and regular dental attention. Each of these subjects has several subdivisions, the teaching of which the dental supervisor would have to work out with the school authorities. Every child in our school system should receive this instruction.

The second or examination phase of the program can be carried out by either of two methods. If the first method is employed, the children are sent by the school authorities to the office of the private dentist for dental inspection. The parents should accompany the child in order that they may be informed of his or her condition. A copy of the dentist's report can be kept by the teacher, who, in turn, should use her influence to have each child's dental defects corrected before the end of the school year. Employing the second method, the school authorities have the local dentists come to the school twice a year—in the fall and in the spring—and examine the mouths of the children. If this method is employed, the parents of the children should be invited to be present at the time of the examination in order that they may see for themselves the child's dental condition. If the parents cannot be present, they should

be notified as to whether dental care is indicated. The teacher should have a duplicate of these records so that she can persuade each child to have his defects corrected. Obviously, in our school system, as in every other school system, there will be some children who, because of financial conditions, cannot have the necessary reparative work done. Therefore, we should include some plan in our program whereby these particular children are furnished this care.

There are many angles to this program which will have to be worked out to meet our particular needs, funds and curriculum. I am confident that they can be worked out satisfactorily. We may decide to confine the entire program or certain parts of the program to the children in the kindergarten and first four grades; we may decide to place the program in charge of the school nurse, or the physical education teacher, or we may decide to employ a dentist or a dental hygienist for this purpose. These are details which we must work out once we have decided to adopt a practical, definite and constructive dental health program.

There is no organization in a better position than yourselves to back a community health day, or a community health week to be devoted to various aspects of the health problem. At that time, the need for new measures such as this can be explained.

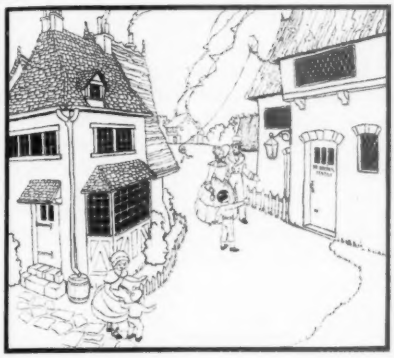
The school children will be enthusiastic; the mothers will be anxious to cooperate. The great service of this club will be that of organization and of providing that solid encouragement needed to put over any ambitious civic project.

Nothing succeeds like success. Several years ago, the citizens of Jackson, Miss., decided that something should be done about the bad condition of their children's teeth. They secured a dentist and assistant to make examinations and recommend treatment. In the largest school in the city, they found only two perfect mouths, when the first examination was made. Then they told the children what was needed and told the mothers what they should do.

They promised a holiday, with a parade and band celebration, to the first school in which the children could present certificates that all had 100 per cent cared-for mouths. Just seven weeks after that offer was made, the first school came forward to claim the reward. It took seven months from the first examination to have every school child's defects corrected, so that April of the first year saw every child in the town with a mouth in good condition—no cavities, no unhealthy gums and no dirty teeth. Such results last. The examinations the next fall disclosed very few faults in those teeth. The children were learning to take care of themselves.

In every city, the dentists are willing to meet the rest of the town half way and more. They are glad to give advice, glad to assist in an organized dental policy. No dentist likes to do work that would not have been necessary had proper care been exercised two, five, ten or fifteen years before. I do not think that anyone, regardless of his occupation, likes to do work that could have been unnecessary. There is too much necessary work to do in the world.

Phillips Brooks says: "He who helps a child helps humanity with an immediateness which no other help given to human creature in any other stage of human life can possibly give again."



Twice a year we come to town
Just to visit Dr. Brown
Dr. Brown our teeth inspects
And keeps them free from all defects.

My Grandfather is very old and he is very wise
He keeps himself in constant trim by daily exercise.
For years Grandad has eaten food which he has had to chew
For being wise he realized teeth need to work hard too.

My dentist says it's his belief
That healthful foods build healthy teeth
So Mother buys on market day
The foods that help prevent decay.

Twice a day we brush our teeth
Those above and those beneath
Mother then with eyesight keen
Looks to see if they are clean.

DENTAL HEALTH POSTERS

A set of four beautifully colored posters, 22 by 28 inches, emphasizing four dental health rules which children should observe in order to have better teeth: proper food, exercise, cleanliness and regular dental attention, are illustrated on the preceding page.

Artistic and fundamentally correct, they make an attractive addition to the dental waiting room and school classroom and are a valuable addition to the health worker's armamentarium.

Approved by the American Dental Association and the U. S. Public Health Service.

Single poster, 35 cents; set of four, $1.00. Distributed by the Bureau of Public Relations, American Dental Association, 212 E. Superior St., Chicago, Ill.

CURRENT LITERATURE

Operation for Double Harelip (F. C. Lee, Georgia M. Ass'n J., October, 1934): Lee stresses the necessity for early operation in double harelip, but states that it is not justifiable until the baby's weight curve is definitely rising and the weight is at least as much as at the time of birth. Ether administered by a motor driven insufflation apparatus is satisfactory, after the patient has been anesthetized lightly with the ether cone. The first step to ensure symmetry is obtained by placing a single stitch of silk as a marker in the midline of the premaxilla at its free edge after a small bit of vermilion border has been removed from that region. Two other stitches as markers are placed through the upper lip at each nostril but inferior to the point where the lip is to be cut across. Both sides of the upper lip should be undercut near the alveolar process, care being taken to remain close to the bone. An incision is then made in each lateral part of the upper lip, as much as possible of the lip that is already formed being used. The incision should afford relaxation in order to bring the respective segments to the midline of the face; therefore, it may be necessary to extend the incision almost parallel with the vermilion border. It is desirable to have a slight redundance, as the excess tissue contracts and gives a better result. The small amount of crimson border that is superior is then removed with a scalpel, care being taken not to enter far into the nostril. After the remaining thin vermilion border on the premaxilla has been removed, care should be taken to leave as much normal skin as possible, and the lateral parts of the new upper lip are brought together in the midline to see whether enough relaxation is present, since thorough and complete relaxation of these lateral pedicles is essential to the repair. The first row of sutures is of silk and is placed with a number three French needle. These sutures are placed first at the nostril of one side, and they approximate the posterior and deeper aspects of the opposing surfaces. The knots are placed on the mucous surface and the threads are cut short. The interrupted suturing is carried anteriorly to the free margin of the newly formed lip and the sutures are placed into the lip and into some of the fibrocartilage in the premaxilla if necessary. The second row of sutures consists of three interrupted sutures of 000 plain catgut: the first suture is put well into the remaining upper lip and into the premaxilla, a similar stitch is placed on the opposite side and a third stitch is placed at the apex of the premaxilla at its junction with the two flaps. The third row of sutures can be either of horsehair or of silk and consists of bringing together the skin anteriorly. In order to ensure neat approximation and a small scar, it is advantageous to use a suture like an end-on-mattress

stitch. A 1 inch piece of a number eight French, soft rubber catheter is inserted into each nostril and held in place with a suture to ensure patency. Compound tincture of benzoin boiled down to a soft putty-like consistency is applied to the sutures in the skin. A Logan bow is attached by means of adhesive strips to the cheeks immediately after operation. This may be left on for two weeks and the muscles of the face should be kept at rest. To this end as much as 3 grains (0.2 gm.) of sodium bromide every two hours may be necessary. Keeping the patient quiet after operation is more important than the use of the Logan bow. The baby should be fed at the regular intervals normal for its age by means of a medicine dropper to which the terminal portion of a soft rubber catheter has been attached. Sutures can be removed at any time after the sixth day. Minor corrective operations may have to be performed to adjust the vermilion border or to excise portions of a broad scar. These operative measures should be taken within three months of the original operation. Massage of the scar and nursing should not be allowed until five weeks after operation. The author gives the results in three cases of double harelip.—Abstr. *J.A.M.A.*, Dec. 1, 1934.

Acute Ulcer of Vulva with Disease of Skin and Oral Mucosa (J. Z. Talalov, Arch. Derm. & Syph., October, 1934): Talalov reports two cases of acute ulcer of the vulva associated with lesions on the skin and mucous membrane of the mouth. In the first case, a girl aged 16 suddenly had a chill, fever, pustular and papulopustular lesions on the skin, numerous ulcers typical of acute ulcer of the vulva on the genitalia and perineum, round the anus, in the inguinal creases and in the right axilla, and aphthalike lesions on the mucosa of the mouth. The smears from the ulcers on the genitalia, in the armpit and in the oral mucosa, as well as the histologic sections of the ulcers from the armpit, showed *Bacillus crassus*. In the second case, a woman aged 28 had aphthous stomatitis and, in connection with the menses, extremely painful ulcers on the genitalia, one of which persisted for one and one-half years. Histologic investigation in the two cases revealed essentially similar pictures both in the ulcers of the armpit and in those of the genitalia. In both cases the changes were revealed chiefly in the region of blood vessels, round which the infiltrate was concentrated. In the first case, the clinical symptoms were caused by the general *Bacillus crassus* infection, with metastases to the skin and mucous membranes; in the second, acute ulcer of the vulva was accompanied by aphthosis.—*J.A.M.A.*, Dec. 8, 1934.

Incisor Teeth of Albino Rats and Guinea Pigs in Vitamin A Deficiency and Repair (S. B. Wolback and P. R. Howe, Am. J. Path., 9:275, 1933): The initial effect of a deficiency in vitamin A on the incisor teeth of rats and guinea-pigs is on the enamel organ. The ameloblasts atrophy, then the remainder of the organ atrophies; finally, metaplasia, calcification and, in the guinea-pig, ossification occur. Atrophy and depolarization of odontoblasts follow changes in the enamel organ. The odontoblasts survive longest on the side (labial), where in apposition to the enamel organ, after long-continued experiments, gross deformities result in rats from the complete or partial failure of dentin formation. Two types of denticles are described, one built up by depolarized odontoblasts, the other formed by inclusion of ameloblasts by the folding of imperfectly formed dentin at the formative end of the tooth. Defective formation of enamel and other poorly understood conditions in teeth, such as denticles, pulp bone and cementicles, may reasonably be regarded in the human being as expressing a possible deficiency in vitamin A. Our observations indicate that in the incisor teeth of rodents the odontoblasts are influenced throughout life by the enamel organ. As in other morphologic problems concerning deficiencies in vitamins, study of the sequences of repair was essential. We emphasize the importance of two types of material for control, the normal and the progressive stages in repair. Our observations indicate that deficiency in vitamin A is the most important of the known

vitamin deficiencies, in its effect on the formation of teeth.—*Am. J. Dis. Child.*, November, 1934.

Mottled Enamel: Drs. Goldenberg in 1917 and Bergara in 1927 reported the results of their experiments on the action of fluorine. Dr. Chaneles in 1930 reported results of a thorough study of the action of fluorine on the teeth of rats. Research has been focused this year on the geographic distribution of mottled enamel in relation to the contents of fluorine in drinking water in Argentina. Dr. R. Erausquin reviewed and completed a map prepared by Dr. Damon, showing the geographic distribution of the dental condition. Dr. J. M. Muñoz performed an analysis of drinking waters in the zones in which the inhabitants have mottled enamel. He found a content of 2.4 mg. of fluorine per thousand cubic centimeters in drinking waters in those zones, by working with Casares' method. Dr. Trelles, however, made some objections on the exactness of the method. (*Semana méd.*, Oct. 4, 1934); abstr. *J.A.M.A.*, Dec. 8, 1934.

Drugs in Tic Douloureux: To the Editor: Please tell me what are most effective in the treatment of tic douloureux? *Answer:* The drug treatment of tic douloureux is notoriously unsatisfactory. Nevertheless, it should be undertaken before injection treatment and surgery are advised. With somewhat of an attempt at causal therapy, one should employ quinine (from 1 to 2 gm. daily for a considerable time) if malarial, or iodide if syphilitic etiology is suspected, iron and arsenic if there is anemia, sodium salicylate (0.6 gm. every hour or two for a few days, then three times daily) with sodium bicarbonate if a rheumatic causation might exist, or castor oil (from 15 to 30 c.c. daily for several weeks, if intestinal intoxication needs to be excluded). From a standpoint of what might possibly be called alterative therapy, strychnine hypodermic injections (from 2 mg. gradually increasing to 12 mg. daily), cannabis (fluidextract from 0.1 to 0.2 c.c. or even more three times daily); or fluidextract of gelsemium (0.05 to 0.2 c.c. or more every two to four hours until dizziness, double vision, dilatation of the pupils, or dropped lids become manifest) might succeed in changing conditions in the nervous system so as to result in at least temporary improvement. The latest addition to the armamentarium in this condition is trichlorethylene, of which from 20 to 25 drops placed on a piece of gauze should be inhaled three or four times daily for a period of from four to six weeks before being discontinued. During the inhalation the patient should be in a recumbent position, as dizziness or drowsiness may be produced. The use of opiates is strictly contraindicated, as there is greater danger from the habit engendered thereby than there would be from destructive injections into the nerves or surgical evulsion of the nerves.—Queries and Minor Notes, *J.A.M.A.*, Dec. 8, 1934.

Erosion of Teeth: To the Editor: Will you kindly tell me the underlying causes and appropriate treatment of erosion of the teeth occurring at the gum line? I have seen a number of cases in which the enamel is apparently worn off just above the gum line with no evidence of infection or irritation of either gums or teeth. This condition occurs in apparently healthy people who evidently employ sufficient mouth hygiene. I have asked a number of dentists about this condition and have received as many different answers, all of which have been unsatisfactory so far as revealing the cause. *Answer:* The cause or causes of erosion of the teeth are not fully understood. There is one variety that is produced by the abuse of the teeth in cleaning them through improper use of the brush and the employment of abrasive dentifrices. Another variety is considered to be the effect of secretions either from the parotid or from the mouth mucous glands. Such secretions in persons suffering from this form of erosion are believed to be capable of dissolving enamel and dentin and tend to stagnate in the groove between the gums and the teeth in places opposite the opening for the discharge of the parotid secretion. The former condition is easily managed, but the latter, although likely to be associated with fluctuations, does not seem to

respond favorably to any known form of treatment. If fillings are placed in the defects, erosion recurs around the filling margins; the use of alkaline preparations is not associated with any considerable degree of improvement, and the effort so far to control the condition by diet or drug therapy has been equally unavailing.—Queries and Minor Notes, *J.A.M.A.*, Dec. 8, 1934.

Cleft Palate: To the Editor: In cases of inoperable cleft palate, at what age and how successfully can dentures be used to close the cleft? How often do they have to be changed and is the average "good dentist" able to handle such an assignment? The patient I have in mind was taken to one of America's leading medical men in this line a few months after birth. He did not believe operation advisable at that time and told the parents to bring the child back at the age of 18 months. They brought the baby back and he told them to wait two years more. The cleft does not appear to be closing up at all. The two year period has about elapsed. *Answer:* It is hardly practical to fit a plate in an open palate before the first permanent molars erupt. The question arises as to whether this is an inoperable case. Most of these patients can be operated on to advantage between the age of 1 and 2 years; there are a few that have a much better chance of success if operation is postponed until the first molar teeth are fully erupted, or even until the first permanent molars have erupted. Any man practicing general dentistry who would take sufficient interest in the case would be capable of handling it if the age and conditions are suitable for a plate.—Queries and Minor Notes, *J.A.M.A.*, Nov. 24, 1934.

Infection of Mouth After Injection of Local Anesthetic: To the Editor: A boy, aged 9 years 11 months, healthy, in good physical condition, somewhat overweight, of a family in good circumstances, had the lower left second temporary molar extracted, Jan. 29, 1934, a procaine infiltration about the root and mandibular nerve block being done. Two or three weeks later, the family noticed a swelling in the left side of the face. The dentist admitted that he had four similar cases after extractions the same week. The dentist had had cultures taken of his stock Ringer's solution, which was used at the time, and a rich mycelium growth resembling *Epidermophyton cruris* was obtained. Also the first of these cases to present itself had been treated by lancing and the packing showed the same fungous growth. About six weeks later, the boy's mother returned from a prolonged absence and became alarmed with the situation. She brought him to me, April 16. At that time, he seemed in good condition and showed no signs except locally, not even the regional lymphatics being involved. There was a firm mass, possibly cystic, the size of a hickory-nut, in the gum tissue on the outer side of the jaw below the missing tooth, and one of similar size in the left cheek just in front of the angle of the jaw. There was no tenderness, edema or redness. I advised no treatment until more could be found out. I checked the story with the dentist and laboratory man. The other cases are proving baffling to other physicians consulted. The dentist informs me that the incised mass in the one case was not benefited, that heat and massage seemed to aggravate another, and that two cases seemed to be gradually improving under no treatment. I have not observed these cases and therefore cannot judge this statement. Meanwhile a dentist, unknown to me, sent the boy to another dentist, who gave him daily treatments, locally, with a water-cooled ultraviolet machine. The boy was given seven daily treatments, when the family again consulted me, and I advised stopping this treatment. There was no appreciable difference in the size of the masses, the skin of the cheek showed considerable erythema, and the boy was in a highly irate frame of mind. I understand on inquiry from an older dentist of great prestige in this community that the ultraviolet treatments are unjustified, as they have no authoritative standing as standard treatment. Are cases like this common? What is the probable condition, and what is the best treatment and management?

What is the likelihood of these masses completely reabsorbing in time? *Answer:* Fungous infections of the mouth are not uncommon, although most of them are superficial. Infections deep in the soft tissues are quite rare and usually are caused by organisms of the actinomyces group. However, Hardgrove *(J. A. Dent. A.,* March, 1932) reported a case of monilia infection carried, in his opinion, into the tissues from the mouth by the needle used in making the anesthetic injection for the extraction of a single tooth. This infection ran a long and involved clinical course; large doses of potassium iodide, from 0.65 to 2 gm. daily, were followed by improvement, but complete relief was obtained only after the use of neoarsphenamine. It was thought that a high protein diet contributed to this end. Castellani ("Fungi and Fungous Diseases") states that fungi may attack any organ and system of the human body, the integumentary system being the most frequently and the nervous system the most rarely affected. The exact identification of the infecting organism is desirable in planning treatment; since the epidermophyton type mentioned is generally limited to infections of the external skin, the correctness of the diagnosis in this case must be questioned. However, such drugs as potassium iodide in large doses are commonly used. Vaccines made of the organisms isolated from the infected regions have been found beneficial in many cases. Surgical incision is without benefit, though excision may be successful, and ultraviolet radiation futile. Sterilized physiologic solution of sodium chloride and Ringer's solution and even distilled water, unless rigidly protected by aseptic methods, may contain noteworthy amounts of bacteria and kindred organisms after a few days. Best anesthetic practice implies daily sterilization of anesthetic solutions or sterilization in containers holding only one day's supply and discarded at the close of one day's use. As this is not an average practice in dental offices, it is a debatable matter whether the method used in these cases should be considered malpractice. Some of the milder infections of this character heal spontaneously.—Queries and Minor Notes, *J.A.M.A.,* Nov. 10, 1934.

Foreign Literature

Symmetrical Extraction of the First Permanent Molars (Mary McLachlan, New Zealand D. J., September, 1934): The author presents the problem of the loss of a first permanent molar by caries and questions what to do with not only the opposing first molar but also the other two molars. The question does not rise from the demands of orthodontia but rather in the broader field when financial interference puts orthodontia out of the question. Also braces for the retention of space are denied. She argues that the extraction of the disease ridden tooth is not enough to meet the case. She asserts that there are mouths that would be better served if the opposing tooth were extracted and also the kindred ones on the other side. Numerous quotations are made from other workers in support of the practice, with modifications. The conclusion drawn is to remove the upper if a lower first molar must be removed. The reverse is not necessarily followed. But the best suggestion the author has to present is the extraction of all four.

Sugar as a Causative Factor in Dental Caries—a Contribution to the Study of Dental Caries (P. M. Coughlin, D. J. Australia, November, 1934): Dr. Coughlin argues that the use of sugar is a direct cause of caries and notes an increase of the disease with the increase of sugar consumption. His observations are empiric entirely, the statistics given being only of the increase in the usage of sugar, none being given to tell the increase of caries during the time covered by his experience.

Roentgen-Ray Examination of Human Teeth (J. Thewlis, Brit. D. J., November, 1934): This is a study of the roentgen-ray examination of the tooth structure itself. Human teeth were used, fourteen in all representing the tooth type. The roentgenogram showed an "outer skin" to the enamel more highly calcified than the remainder of the tooth. Likewise, the rays showed that the inner or pulpal surface of dentin was

less calcified than the remainder of the tooth. The enamel in different teeth showed different degrees of calcification and different areas in the same teeth.

Barbituric Arthralgia and Myalgia (P. Castin and P. Gardien, Presse Méd., Oct. 3, 1934): Castin and Gardien report six cases in which joint or muscle pains developed in the course of barbiturate administration. The painful symptoms were unaccompanied by objective signs except for the discomfort connected with the pain. There were no sensory or vasomotor disturbances or abnormalities of the tendon reflexes of the affected limb. Only one patient showed atrophy of the right deltoid. Only one articulation was usually involved, but it seemed that its functional incapacity was due to the muscles which move it. These pains seemed to occur only after prolonged administration of the drug. No marked sexual distribution is apparent, and the age distribution appears to be simply in proportion to the frequency of use. The authors state that as a general rule the barbituric algesias are no more a contraindication to the use of this drug than are the skin eruptions and other reported complications.—Abstr. *J.A.M.A.*, Dec. 8, 1934.

Case of Mucin Cyst (Retention Cyst) of Hard Palate (A. N. Weissblatt, Ztschr. D. Stomatol., No. 32, 1934, pp. 735-740): The author describes a case of a retention cyst of the hard palate. He gives the complete history, diagnosis, pathology and treatment of the case. He draws the following conclusions: 1. Retention cysts may localize on any part of the mucous membrane, not only on the lips, cheek and soft palate, but also on the hard palate. 2. In the diagnosis of a cyst, puncturing of the cyst is of primary importance. 3. Trauma may be the cause of retention cyst formation. 4. Mucinous retention cysts in the mouth may be operated on under infiltration anesthesia with regard of location and size.

Problem of Inheritance in Dentistry (R. Trauner, Ztschr. Stomatol., No. 31, 1933, pp. 283-291): Since it is well established that a certain inherited gene influences certain organs or parts of organs and that one organ is built up through the influence of many genes, it is possible by studying the mutual inheritability of various anomalies to get an idea about the plan of formation of the human body. The author reports the following: The commonly inherited defects of the hair, teeth and nails show the same occurrence, all being built from the ectoderm. The mesodermal portion of the tooth undergoes the same changes as bone in osteogenesis. With the formation of a cleft palate, fistulas of the lower lip are often inherited. There is also a tendency for inheritance of the upper or lower lip form.

Study of Acute Osteomyelitis of the Mandible (A. Bruciaferri, Gaz. Internaz. d. Med. e Chir., Sept. 30, 1934): Acute osteitis of the mandible includes periostitis, osteomyelitis and finally necrosis as various stages in the morbid process. The author divides the disease into four different groups. 1. Osteoperiostitis of the mandible is the most frequently observed form as well as the least grave. It always develops by propagation of a lesion of buccal origin. 2. Osteomyelitis of hematic origin may be a primary disease or there may be a previous infection in another location. The causative organism is most frequently the staphylococcus, more rarely the streptococcus. Traumas or extreme cold may favor its development. 3. Osteomyelitis may be caused by dental diseases. 4. Osteomyelitis may be caused by disturbances in the eruption of the third molars. The author discusses the pathologic processes characteristic of each of these forms and gives suggestions for their diagnosis and treatment.

Calcium in the Saliva of Tuberculous Patients (Omero Tempestini, Stomatologia, October, 1934): The author has studied the amount of calcium contained in the saliva of 100 persons with pulmonary tuberculosis and has discovered in it a greater quantity than in that of normal persons. The largest quantities are found in patients with rapidly evolving forms, with toxemia and with recurrent hemorrhages. Smaller amounts of calcium are found in chronic forms with slight toxemia and in

patients who are in comparatively good condition. The author has found no constant relationship between the state of the teeth and the amount of calcium in the saliva. Since the knowledge on the problem of dental decalcification in tuberculosis is as yet incomplete, the author hesitates to come to any conclusion. He notes that the greater quantity of calcium might be due to the alkaline reaction of the saliva in tuberculosis. The alkaline reaction and the increased calcium content can be considered as local conditions which inhibit the development of dental caries in the tuberculous organism.

Considerations on Penetration of Roots into Maxillary Sinus During Extractions (A. Bouland, Semaine Dent., Nov. 11, 1934): The anatomic proximity of certain teeth and the maxillary sinuses is the cause of frequent accidents during extractions. The teeth most commonly involved are the two bicuspids and the first and second molars. Infections and lesions of the teeth and roots lead to modifications in the resistance of the tissues, which, in turn, favors the development of the accident. It is not a question of a fault on the part of the operator, but it is an inherent risk because of the operative region. The consequences of the accident are not usually grave. The patient should be told of the accident and roentgenograms should be taken immediately to guide the specialist in the removal of the root. The author has several case reports with ample illustrations of diagrams and roentgenograms. From a medicolegal standpoint, the author advises practitioners to carry insurance to cover risks. The companies should be warned after such an accident occurs. These cases are usually not carried to court, because the patient can be convinced that the accident was not a result of faulty operative procedure.

General Considerations on Temporary Deciduous Teeth (Mateu Cebra, Paidoterapia, November, 1933): The deciduous teeth have not only masticatory function during the early years, but also that of guiding and favoring the development and eruption of the permanent teeth. The origin of the permanent teeth is a normal physiologic process, but in certain cases the teeth appear in an abnormal manner. Therefore, it is absolutely necessary to watch closely the evolution of the permanent teeth by instituting an efficient prophylaxis of dentition troubles in the deciduous teeth and continuing this prophylaxis until the permanent teeth are all present.—Abstr. *Am. J. Dis. Child.*, November, 1934.

NEWS

CALIFORNIA

Cult Initiatives Defeated: Newspapers, November 8, reported that the chiropractic initiative in California was defeated almost two to one in voting returns. A signal defeat was also indicated for the naturopathic initiative.

COLORADO

Malpractice: Contemporaneous Tonsillectomy and Extraction of Teeth: Hughes was suffering from rheumatism and chronic myocarditis. His physician advised the removal of his tonsils and an x-ray examination of his teeth, which examination was made by the defendant Brown, a dentist. The defendant Desmond, a physician, was then called in and advised the removal of the tonsils and the extraction of at least some of the teeth while the patient was under the anesthetic for the tonsillectomy. The defendant physician performed the tonsillectomy, and the defendant dentist extracted some infected teeth, but only sixteen of them, although the patient had insisted on the extraction of all his teeth. The patient died one week later. Contending that

it was improper, in view of the patient's condition, to remove the tonsils and so many teeth at one time, his widow sued the defendant-physician and dentist. A verdict was given for the plaintiff and the defendants appealed to the Supreme Court of Colorado.

All that was required of the physician and dentist, said the Supreme Court, in this case, in diagnosing and treating their patient, was such a degree of skill and care as was ordinarily possessed by those in the practice of their respective professions, under similar circumstances and in their particular locality. Whether or not these requirements are met can usually be determined only from the opinions of witnesses learned in the corresponding professions. There is no actionable violation of a duty when only the best judgment, under the circumstances of the case, is required and is used. The burden is on the plaintiff to establish negligence. The evidence here shows that the defendants possessed ordinary and reasonable learning and skill in their professions and that the practice they followed had been successful in similar cases. The plaintiff called several expert witnesses, some of whom said that they would not have pulled more than two or three teeth but the majority of whom testified that such matters were to be left to the best judgment of the operator. The defendants called many experts, who testified, in substance, that operations similar to those performed in this case are followed with desirable results. Who can say with certainty that the defendants abandoned the field of accepted practice? There must be a clearer case of total abandon than here appears before liability occurs, otherwise the learned judgment of the skilled professions of medicine and dentistry would be lost to the human race.

Further, said the Supreme Court, the burden was on the plaintiff to show that the acts of the defendants were the direct cause of death. No such evidence was produced. The fact that there is a lamentable result does not of itself satisfy that burden imposed on the plaintiff. The burden is not met by showing that death might have resulted from the operation complained of, and it is improper to allow jurors to conjecture as to the efficient and proximate cause. The possibility of death as the result of such operation is not sufficient; there must be evidence eliminating the intervention of other causes which might exist.

For the reasons stated, the judgment in favor of the plaintiff was reversed.—Brown v. Hughes (Colo.), 30 P. (2d) 259. —*J.A.M.A.*, Dec. 8, 1934.

CONNECTICUT

Tablet to Dr. Wells in Original Location: The *Hartford (Conn.) Times* of December 6 reports the restoration of a tablet commemorating the discovery of anesthesia by Horace Wells. The tablet was placed on a building which stands on the site of the structure in which Dr. Wells worked and in which he submitted to the anesthetic that he had discovered. On the fiftieth anniversary (Dec. 11, 1894) of his discovery, this tablet, costing $2,500, was dedicated. The late Dr. James McManus, prior to the unveiling of the bronze, had moved that it be presented to the city of Hartford. The mayor at that time accepted the memorial in behalf of the city and assured the Connecticut Dental Association that the common council would approve the act. This was never done. Later, the building bearing the memorial was razed and the tablet was misplaced. It was located by Dr. Joseph Tully in the possession of the company that owned the new building. At a meeting in New London, in April, 1934, a committee was appointed, composed of Drs. Charles A. Hunt, Charles W. Roberts and Joseph A. Bray to see that the memorial was officially accepted by the Hartford Dental Society. This was done and the same committee was empowered to plan for the future care of the memorial. They secured the written consent of the company owning the building to place the tablet thereon. This tablet was paid for by practicing dentists only, the donors scattered from coast to coast, "a local act but a friendly tribute from the entire country." The inscription reads: "To the memory of Horace Wells, dentist, who upon this spot,

December 11, 1844, submitted to a surgical operation, discovered, demonstrated and proclaimed the blessings of anesthesia." The bronze is 5 feet long and 29 inches wide.

FLORIDA

Officers Elected: At the fifty-first annual meeting of the Florida State Dental Society, October 18-20, officers for 1935 were elected. C. P. Cleveland, Jacksonville, is the new president.

Dr. Pattishall Gets Appointment: Governor Sholtz has appointed H. B. Pattishall, of Jacksonville, to fill the unexpired term of R. P. Taylor, who resigned, after twenty-six years, as a member of the Florida State Board of Dental Examiners. He had also been the secretary and treasurer of the board for many years. Dr. Pattishall has also been appointed secretary-treasurer.

Paid Up Members: Three hundred and thirty-four members out of a possible 520 were reported by the Florida State Dental Society as paid up. This is a gain of eighteen over last year.

Member Honored: J. E. Chace, Ocala, was introduced to the state society organization as having recently been made a Fellow of American College of Dentists at their meeting in St. Paul.

Record Attendance: The Northwest District registered 99 per cent at the state meeting. Two members were unable to attend in a district which is over 200 miles long.

Fellowship Conferred: The degree of honorable fellow was conferred on Charles W. Smith, Pensacola, who has completed twenty-five continuous memberships in the state society, and who served as president in 1911.

Plan for Indigent Approved: The plan of the Special Committee on School Clinics for indigent children in all counties was approved and the Legislative Committee instructed to prepare the necessary legislation. The plan is proposed to be financed by taxes which are apportioned to all counties.

FLORIDA

At a meeting of the Dade County Medical and Dental societies, October 5, Frank R. Morrow, M.D., and J. Harold Klock, D.D.S., Miami, discussed the relation of medicine to dentistry.

ILLINOIS

Dental Survey: The state department of health and the Illinois State Dental Society are cooperating in a fall and winter dental health survey of school children. Diet and periodic dental inspections with the aim of preventing tooth decay will be emphasized. In the educational program to coincide with the survey, prenatal care, especially from the standpoint of the diet of prospective mothers, and the diet of children will be particularly stressed in connection with efforts to prevent dental decay. The periodic inspection of teeth and the prompt correction of caries were also emphasized.

Dr. Gordon on Program of Illinois Societies: Samuel M. Gordon, Ph.D., spoke on the work of the Council on Dental Therapeutics of the A.D.A. before the St. Clair District Dental Society at Belleville November 1 and the Springfield Dental Society, at Springfield, December 13. At the La Grange Chemist Club, he spoke on "Fake Dentifrices," November 26.

INDIANA

Dentists Organize Orchestra: An orchestra composed entirely of members and affiliates is the latest development of the Indiana State Dental Society. W. E. Barb is organizer and director. At one time, Dr. Barb and Don Irwin were members of the Charlie Davis band playing in local theaters. According to Dr. Barb, the orchestra, the only one of its kind in the country, will be taken to meetings of dental societies in Columbus, Ohio, Louisville, Chicago and other surrounding cities.

Good Teeth Council Activity: The Indiana Division of the Good Teeth Council for Children, under the direction of Mary H. Westfall, through a puppet show has made contact with more than 80,000 people since the first of the year.

MASSACHUSETTS

Dr. Adams Appointed A.D.A. Trustee: Philip E. Adams, assistant professor of or-

thodontia at the Tufts Dental School, Boston, has been appointed Trustee of the American Dental Association for the first district, succeeding Albert W. Crosby, late of New Haven, Conn. For some years, Dr. Adams has been secretary of the Massachusetts State Dental Society.

Opportunity for Massachusetts Dentists: There is in Massachusetts an organization known as the 4-H Club, with a membership of 20,000 boys and girls from 10 to 20 years of age. It is a branch of the National 4-H Club and is controlled through the Federal Department of Agriculture and the Massachusetts State College. Its health activities are supervised by the Massachusetts Department of Public Health. It is distinctly a rural organization and has unit clubs in practically every rural community in the state. Through the cooperation of the Massachusetts Dental Society with the Massachusetts Department of Health and the Massachusetts State College, a plan is being arranged whereby all of these boys and girls, participating in a "Protect Your Smile" program, are to receive, through the Department of Health, instruction in diet and home care for the development and preservation of mouth health. All Massachusetts dentists practicing in rural districts are to be given an opportunity, through the Massachusetts Dental Society, to participate in this program.

MICHIGAN

Addresses Annual Public Health Conference: November 8, Samuel M. Gordon, Secretary of the Council on Dental Therapeutics, addressed the Fourteenth Annual Public Health Conference at Lansing, Mich., on "Mouth Washes and Dentifrices: Their Advertising and Public Health Work."

MINNESOTA

Dr. Gordon Addresses Society: Samuel M. Gordon, secretary of the Council on Dental Therapeutics, delivered an address on the work of the Council before the Minneapolis District Dental Society, November 15.

Washington University School of Dentistry Alumni Association Honors Former Dean: At the annual meeting of the Alumni Association of the Washington University School of Dentistry, February 22-23, a bronze plaque will be unveiled in memory of John H. Kennerly, former dean of the college. Dr. Kennerly held office in his local and state societies and was always very keenly interested and active in dental education.

NEBRASKA

Dr. Miller Receives Honor Key: Howard C. Miller of Chicago, a graduate of Creighton in 1916, was the principal speaker at the Creighton Dental Alumni Homecoming. At a banquet recently, he was presented with the honor key of the school by Charles E. Woodbury.

Dr. Heinman Honored: P. T. Heinman has been appointed to the Nebraska State Board of Dental Examiners, replacing L. A. Donahoe.

NEW YORK

Medical and Dental Meeting: At a joint meeting of the medical and dental professions of Greater New York, held December 3, papers were presented by Samuel C. Burchell and Joseph Schroff on "The Burning Tongue" and by Isadore Rosen on "Dermatologic Manifestations of Oral Diseases and Oral Manifestations of Systemic Diseases." Edward C. Rosenow, Rochester, Minn., spoke on "Importance of Focal Infection as Related to Health," and Frank M. Casto, President of the American Dental Association, on "Transition in the Art and Science of Dentistry." Maurice O. Magid presented the results of a questionnaire sent to medical and dental colleges in the United States and Canada.

Tree Memorial to Madame Curie: The sixty-seventh birthday of the late Madame Marie Curie, November 7, was observed by the planting of a tree in City Hall Park, with ceremonies in which Mayor La Guardia and Park Commissioner Robert Moses participated. Various French and Polish societies and the consul generals of France and Poland also took part.

Dr. Hanks Appointed Federal Dental Advisor: Mr. Harry L. Hopkins has announced the appointment of John T.

Hanks, of New York City, as dental advisor to the Federal Emergency Relief Administration. It is indicated that Dr. Hanks will be in consultation monthly with the Committee on Economic Security.

Membership: The present membership in good standing in the nine districts of the state society is 3,718.

NEW YORK

Symposium on Psychiatry: A symposium on various phases of psychiatry and psychoanalysis was presented at a meeting of the International and Spanish-Speaking Association of Physicians, Dentists and Pharmacists, November 16, by Frank Pearcy, George W. Henry, Alfred Adler, Victor E. Sears, and Lyon Jacobs, attorney, Montreal, Canada.

Addresses Dental Centennial Meeting: Samuel M. Gordon delivered an address on the work of the Council on Dental Therapeutics and also presented an exhibit of the Council's work at the New York Dental Centennial Meeting, December 3-7.

OHIO

Dr. Rickert Honored: The Callahan Memorial Award was conferred on U. G. Rickert, Ann Arbor, Mich., at the Sixty-Ninth Annual Session of the Ohio State Dental Society, November 19.

WASHINGTON, D. C.

Dentistry Represented on a Committee for Selecting a New Health Officer: On the committee charged with the selection of a new health officer is the name of one of the A.D.A. Trustees, Willard Camalier, representing the District of Columbia Dental Society. The other names on the committee were: William E. Hough, representing the District Medical Society; Earl B. McKinley, George Washington University Medical School; Assistant Surgeon-General W. F. Draper; Numa P. G. Adams, Howard University Medical School, and E. C. Wiggins, Medico-Chirurgical Society. William G. Morgan, formerly president of the District Medical Society, is chairman of the committee.

Medical Bureau for the Needy: Creation of a medical admitting bureau in Washington for persons seeking free medical care has been endorsed by the Medical Society of the District of Columbia. It is proposed that the bureau be operated in cooperation with the Community Chest and handle all applications for free treatment at medical clinics or for free hospital care. The plan endorsed by the society calls for a special supervising committee, consisting of members from the executive committee of the Community Chest, the hospital superintendents' association and the medical and dental societies.

FOREIGN

Dr. Arnott Made Dean: At the last meeting of the Senate of the University of Sydney, A. J. Arnott was unanimously elected to fill the position of professor of dentistry and dean of the Faculty of Dentistry.

GENERAL

Public Warned Against New Drugs, Cinchophen and Amidopyrine: Widespread use of two dangerous drugs—one which destroys the liver and the other which kills the white corpuscles of the blood—has brought a warning from the Federal Food and Drug Administration. These drugs are cinchophen and amidopyrine. Cinchophen, a chemical anodyne and sedative, is sometimes used by sufferers from neuralgia, rheumatic pains, neuritis and similar conditions. Amidopyrine is frequently found in headache remedies and other pain killers. "Current medical literature contains many reports which clearly indicate that these drugs are dangerous to health and life," says W. G. Campbell, chief of the Food and Drug Administration. "The gradual development of serious poisoning from the use of these drugs is often so insidious that the danger is not recognized by the user. Cinchophen causes a degeneration of the liver cells. Amidopyrine may cause a reduction in the number of white blood cells, a condition called agranulocytosis." In issuing the warning, Mr. Campbell made it plain that he was not implying that all headache and rheumatism remedies contained these dangerous drugs. But the fact that some of them do is sufficient reason for the public to be careful. Several

manufacturers declare on their labels the presence of these drugs in their medicines, but others do not. There is no provision in the Food and Drugs Act to compel manufacturers to declare either drug. The Federal Food and Drugs Act requires manufacturers to declare on the labels of their products the presence of several narcotic drugs. When the law was passed, cinchophen was unknown and the danger-effects of amidopyrine had not been recognized. For these reasons, these drugs were not included in the list. Under present conditions, buyers should observe two precautions, says Campbell: Read the label and look for statements of the presence of these drugs, and if they are not declared and there is any doubt, ask the druggist or write to the Food and Drug Administration in Washington and ask for the facts.

Deaths

Boak, Seibert D., San Francisco, Calif., died November 22; aged 58. Dr. Seibert was a colonel in the Dental Corps.

Dismukes, William, Nashville, Tenn.; Ohio College of Dental Surgery, University of Cincinnati, 1874; died recently; aged 84.

Friedman, Samuel, Chicago, Ill.; Northwestern University Dental School, 1908; died November 23; aged 55.

Griswold, G. M., Hartford, Conn.; died September 12; aged 77.

Kutcher, Ernest, Staten Island, New York; University of Buffalo, School of Dentistry 1915; died November 3.

Molt, Theodore F., Clinton, Iowa; Chicago College of Dental Surgery, 1886; died November 26; aged 79.

Thompson, John F., Hartford, Conn.; Baltimore College of Dental Surgery, University of Maryland, 1913; died September 28.

Waas, Milton J., Camden, N. J.; University of Pennsylvania, 1906; died recently.

Wille, John Mather, Merchantville, N. J.; Dental Department, University of Pennsylvania, 1923; died October 25; aged 34.

Whipple, John A., Peoria, Ill.; Northwestern University Dental School, 1889; died recently; aged 79.

MISCELLANY

BOOK REVIEW

Clinical Pathology of the Jaws. By Kurt H. Thoma. Published by Charles C. Thomas, Springfield, Ill. and Baltimore, Md., 1934. Price, $9.00.

The author of this text has been well known to the dental profession for a great many years, not only as a teacher but also as a practicing surgeon. The book comprises, in addition to the author's experiences, the results of investigation carried on in the laboratory of oral pathology of the Harvard University Dental School. Thoma notes that the jaws are the "no man's land" of the human body, the physician leaving their diseases to the care of the dentist and the dentist so involved with teeth that he has little experience with disease of the maxilla and mandible. In an endeavor to improve the situation, Thoma constructs a volume of 600 pages and 423 illustrations packed with discussion and case histories, to enable the dentist—or physician, if he is interested—to fit himself for diagnosis and treatment, at least in theory. It is a practicing surgeon's opinion, voiced in a huge volume, of a need in dentistry. It is an attempt to depict on paper what happens "in the flesh" which however well done cannot take the place of seeing, touching, treating the real thing. The book is a fine companion for clinical experience, a background for bedside and chairside observation and understanding. T.

CORRESPONDENCE

"Congenital Absence of Twenty-Three Permanent Teeth"

To the Editor:

In the November, 1934, number of The Journal, I cited a case, "Congenital Absence of Twenty-Three Permanent Teeth: Report of Case," taken from the files of the Mayo Clinic. This case seemed to me very interesting and I accordingly reported it in conjunction with Joseph L. Dillery, then my assistant. At the time I reported the case, it had been in our files about three years, and I regret that we failed to mention that Dr. C. A. Noland of Monroe City, Mo., referred the patient to us. Our clinic always aims to be most punctilious in giving credit in connection with any services rendered us, and I trust that Dr. Noland may feel that if I failed to accord with customary procedure in this case, it was wholly unintentional.

Boyd S. Gardner.

RESOLUTION REGARDING MAIL-ORDER ORTHODONTIA LABORATORIES

Whereas, dentistry is being exploited by commercialized orthodontia in the form of mail-order diagnostic and treatment laboratories, which are a public and professional menace to the present day standards of orthodontic practice; and

Whereas, a large number of these firms are advertising appliances now considered obsolete and unreliable in the hands of the general practitioner; and

Whereas, the advertisements of these laboratories misrepresent orthodontia by making misleading statements and offer different inducements in gathering mailing lists of prospective customers to circularize with false and unwarranted assertions about orthodontia; and

Whereas, some of these laboratories are operated by technicians who never graduated from a dental college or became licensed practitioners; and

Whereas, the system is but a malicious method of selling appliances and contrary to the rules of professional ethics; and

Whereas, their pretensions and system can only be recognized as a form of dental quackery, which violates the intents and purposes of state laws regulating the practice of dentistry; therefore, be it

Resolved, that the Southern Section of the Pacific Coast Society of Orthodontists, in regular meeting at the University Club on Sept. 14, 1934, register their disapproval and condemn the mail-order system of orthodontic practice as being detrimental to the best interests of the welfare of the public seeking orthodontic service; and

Resolved, that a copy of these resolutions be spread on the minutes of the society and a copy sent to the publishers of all proprietary dental journals urging them to discontinue this type of advertising: and

Resolved, that a copy of these resolutions be sent to all the officers of the American Dental Association and the American Society of Orthodontists.

C. C. Thompson, *Secretary-Treasurer,*
Southern Section, Pacific Coast
Society of Orthodontists.

DIRECTORY OF STATE SOCIETY OFFICERS AND DATES OF MEETINGS, 1935

ALABAMA

W. S. Mims, President.....Huntsville
Hunter S. Allen, Secretary-Treasurer.....First Nat'l Bank Bldg., Birmingham
Date of next meeting: April 16-18, 1935.
Place of next meeting: Birmingham.

ARIZONA

S. T. Adams, President.....Consolidated Bank Bldg., Tucson
John S. McCall.....Professional Bldg., Phoenix
Date of next meeting:
Place of next meeting:

ARKANSAS

W. O. Finch, President.....Jonesboro
I. M. Sternberg, Secretary-Treasurer....Merchants Nat'l Bank Bldg., Fort Smith
Date of next meeting: May 13-15, 1935.
Place of next meeting: Little Rock.

CALIFORNIA

Charles A. Sweet, President.....242 Moss Ave., Oakland
Frederick T. West, Secretary.....2180 Washington St., San Francisco
John W. Leggett, Treasurer.....490 Post St., San Francisco
Date of next meeting: April 8-10, 1935.
Place of next meeting: Oakland.

SOUTHERN CALIFORNIA

Harry R. Hancock, President.....1836 State St., Santa Barbara
Stanley Rice, Secretary.....1048 Roosevelt Bldg., Los Angeles
Earl J. Thee, Treasurer.....3780 Wilshire Blvd., Los Angeles
Date of next meeting: July 8-12, 1935.
Place of next meeting: Long Beach, Calif. (Pacific Coast Dental Conference).

COLORADO

E. E. Bailey, President.....1124 Republic Bldg., Denver
O. H. Devitt, Secretary.....523 Republic Bldg., Denver
Edward C. Carter, Treasurer.....962 Metropolitan Bldg., Denver
Date of next meeting:
Place of next meeting:

CONNECTICUT

William B. Brewster, President.....111 West Main St., Waterbury
C. W. Vivian, Secretary-Treasurer.....58 Elbridge Road, New Britain
Date of next meeting: May 8-10, 1935.
Place of next meeting: Waterbury.

DELAWARE

D. J. Casey, President.....Medical Arts Bldg., Wilmington
M. Greenstein, Secretary.....Medical Arts Bldg., Wilmington
P. A. Traynor, Treasurer.....807 Washington St., Wilmington
Date of next meeting: Jan. 9, 1935.
Place of next meeting: Wilmington.

DISTRICT OF COLUMBIA

B. Edwin Erikson, President...3726 Connecticut Ave., N. W., Washington, D. C.
Stephen C. Hopkins, President Elect...1726 Eye Street N. W., Washington, D. C.
William M. Simkins, Sec'y-Treasurer...720 Woodward Bldg., Washington, D. C.
Date of meeting: 2nd & 4th Tuesdays in each month.
Place of meeting: George Washington University, Medical School.

FLORIDA

C. P. Cleveland, President.....St. James Bldg., Jacksonville
George M. Shields, President Elect.....816 Congress Bldg., Miami
E. B. Penn, Secretary-Treasurer.....Seybold Bldg., Miami
Date of next meeting:
Place of meeting:

GEORGIA

G. C. Hunter, President.....La Grange
R. H. Murphy, Secretary.....Georgia Gas Bldg., Macon
Bryant K. Vann, Treasurer.....Candler Bldg., Atlanta
Date of next meeting: May 13-15, 1935.
Place of next meeting: Ansley Hotel, Atlanta.

HAWAII

Joseph A. Pekelo, President.....471 S. Beretania St., Honolulu
J. K. Kahaleanu, Secretary-Treasurer.....1136 Punchbowl St., Honolulu
Date of next meeting:
Place of next meeting:

IDAHO

John D. Lowe, President.....Burley
H. J. Dyer, Treasurer.....Shelley
Date of next meeting:
Place of next meeting:

ILLINOIS

J. K. Conroy, President.....Belleville
B. H. Sherrard, Secretary.....300 Rock Island Bank Bldg., Rock Island
Burne O. Sippy, Treasurer.....30 N. Michigan Ave., Chicago
Date of next meeting: May 14-16, 1935.
Place of next meeting: Quincy.

INDIANA

W. C. Hessler, President.....312 Ben Hur Bldg., Crawfordsville
A. R. Ross, Secretary.....Murdock Bldg., Lafayette
William Bogie, Treasurer.....214 Main Street, Vincennes
Date of next meeting: May 20-22, 1935.
Place of next meeting: Indianapolis.

IOWA

Roy S. Sommers, President.....Equitable Bldg., Des Moines
Erling Thoen, President Elect.....Iowa City
John Scholten, Secretary.....810 Dows Bldg., Cedar Rapids
H. J. Altfillisch, Treasurer.....722 Roshek Bldg., Dubuque
Date of next meeting: May 7-9, 1935.
Place of next meeting: Des Moines.

KANSAS

J. Scott Walker, President.....Chetopa
Fred A. Richmond, Secretary..... Federal Life Bldg., Kansas City
W. T. Triplett, Treasurer.....Salina
Date of next meeting: April, 1935.
Place of next meeting: Wichita.

KENTUCKY

E. H. Hubbuch, President.....824 Starks Bldg., Louisville
J. H. Fullenwider, Secretary-Treasurer.....1101 Heyburn Bldg., Louisville
Date of next meeting: April 1-3, 1935.
Place of next meeting: Paducah.

LOUISIANA

Julian S. Bernhard, President.....Medical Arts Bldg., Shreveport
Malcolm E. Kaffie, Secretary.....Medical Arts Bldg., Shreveport
Oscar J. Ory, Treasurer.....Garyville
Date of next meeting: Time of A.D.A. meeting (Nov. 4-8, 1935).
Place of next meeting: New Orleans.

MAINE

F. Stanley Walker, President.....Presque Isle
George A. Phillips, Secretary.....31 Central St., Bangor
D. S. Roberts, Treasurer.....655 Congress St., Portland
Date of next meeting: June 21-22, 1935.
Place of next meeting: Augusta.

MARYLAND

D. C. Blevins, President.....Centreville
Walter L. Oggesen, Secretary.....St. Paul & 23rd Sts., Baltimore
Walter E. Green, Treasurer.....2958 North Ave. W., Baltimore
Date of next meeting: May 6-8, 1935.
Place of next meeting: Baltimore.

MASSACHUSETTS

William Hayes Hoyt, President.....77 Newbury Street, Boston
Philip E. Adams, Secretary.....106 Marlborough St., Boston
Joseph T. Paul, Treasurer.....419 Boylston St., Boston
Date of next meeting: April 29-May 2, 1935.
Place of next meeting: Boston.

MICHIGAN

M. Webster Prince, President.....7634 Dexter Blvd., Detroit
William R. Davis, Secretary.....Michigan Department of Health, Lansing
E. J. Chamberlain, Treasurer.....519 Ashton Bldg., Grand Rapids
Date of next meeting: April 15-17, 1935.
Place of next meeting: Detroit.

MINNESOTA

C. C. Sparrow, President.....LaSalle Bldg., Minneapolis
M. H. Thornton, President Elect.....Selby & Snelling Aves., St. Paul
L. M. Cruttenden, Secretary.....Lowry Medical Arts Bldg., St. Paul
A. R. Schmid, Treasurer.....Worthington
Date of next meeting: Feb. 26-28, 1935.
Place of next meeting: Minneapolis.

MISSISSIPPI

T. J. Burnham, President.....Magee
M. L. Jones, Secretary-Treasurer.....Meridian
Date of next meeting: April 22-24, 1935.
Place of next meeting: Jackson.

MISSOURI

George E. Haigh, President.....Jefferson City
C. W. Digges, Secretary.....Columbia
James F. McLellan, Treasurer.....Moberly
Date of next meeting: May, 1935.
Place of next meeting: Jefferson City.

MONTANA

R. W. Kelly, President.....Billings
O. A. Kenck, Secretary-Treasurer.....Augusta
Date of next meeting: May 9-11, 1935.
Place of next meeting: Lewiston.

NEBRASKA

E. A. Litchfield, President.....Medical Arts Bldg., Omaha
F. A. Pierson, Secretary.....1014 Federal Trust Bldg., Lincoln
G. L. Spencer, Treasurer.....Sharp Bldg., Lincoln
Date of next meeting: May 20-23, 1935.
Place of next meeting: Omaha.

NEW HAMPSHIRE

E. S. Kent, President.....Portsmouth
W. J. Moyles, Secretary.....1061 Elm Street, Manchester
W. A. Young, Treasurer.....Concord
Date of next meeting: June 26-27, 1935.
Place of next meeting: Rye Beach.

NEW JERSEY

E. J. H. Schneider, President.....519 Prospect Street, Maplewood
E. J. Jennings, President Elect.....126 W. State St., Trenton
F. K. Heazelton, Secretary.....223 E. Hanover St., Trenton
George H. Griffith, Treasurer.....42 W. State Street, Trenton
Date of next meeting: April 24-25, 1935.
Place of next meeting: Atlantic City.

NEVADA

C. E. Rhodes, President.....Medico-Dental Bldg., Reno
H. E. Cafferata, Secretary-Treasurer.....320 First Nat'l Bank Bldg., Reno
Date of next meeting: Nov. 29, 1934.
Place of next meeting: Reno.

NEW MEXICO

Paul G. Henry, President.....Las Vegas
Fred Muller, Secretary-Treasurer.....Taos
Date of next meeting: July, 1935.
Place of next meeting: Las Vegas.

NEW YORK

Augustave Neuber, President.....619 Union Street, Schenectady
A. P. Burkhart, Secretary.....57 East Genesee St., Auburn
George H. Butler, Treasurer.....Skaneateles
Date of next meeting: June 12-15, 1935.
Place of next meeting: Upper Saranac Lake.

NORTH CAROLINA

L. M. Edwards, President.....Durham
D. L. Pridgen, Secretary-Treasurer.....Fayetteville
Date of next meeting: June 17-19, 1935.
Place of next meeting: Blowing Rock.

NORTH DAKOTA

V. E. Sandberg, President.....Minot
I. W. Slingsby, Secretary.....55½ Broadway, Fargo
L. C. Schmitz, Treasurer.....Jamestown
Date of next meeting: May, 1935.
Place of next meeting: Grand Forks.

OKLAHOMA

J. A. Wells, President.....Shawnee
Francis J. Reichmann, Secretary.....1205 Medical Arts Bldg., Oklahoma City
C. B. Ball, Treasurer.....Frederick
Date of next meeting:
Place of next meeting:

OHIO

O. B. Kneisly, President.....American Bldg., Dayton
Edward C. Mills, Secretary.....255 East Broad St., Columbus
Harry Cope, Treasurer.....327 East State St., Columbus
Date of next meeting:
Place of next meeting:

OREGON

P. T. Meaney, President.....Selling Bldg., Portland
F. W. Hollister, Secretary-Treasurer.....Selling Bldg., Portland
Date of next meeting: June 5-8, 1935.
Place of next meeting: Portland.

PANAMA

W. H. Grant, President.....Ancon
Thomas C. Daniels, Vice President.....Fort Clayton, Canal Zone
Louie H. Crowl, Secretary-Treasurer.....Cristobal
Date of next meeting:
Place of next meeting:

PENNSYLVANIA

Walter E. Lotz, President.....Masonic Bldg., Tyrone
Thomas P. Fox, Secretary.....1614 Locust St., Philadelphia
J. H. Corcoran, Treasurer.....Scranton Life Bldg., Scranton
Date of next meeting: May 7-9, 1935.
Place of next meeting: Altoona.

PHILIPPINE ISLANDS

Eladio R. Aldecoa, President.....1742 Rizal Avenue, Manila
Victorino G. Villa, Secretary-Treasurer.....579 E. Pennsylvania St., Manila
Date of next meeting: February, 1935.
Place of next meeting: Manila.

PUERTO RICO

Jose Vicente, President.....Box 100, San Juan
J. R. Hernandez Gonzales, Secretary.....Box 1361, San Juan
R. Fernandez Carballo, Treasurer.....Box 3291, Santruce
Date of next meeting:
Place of next meeting:

RHODE ISLAND

Harry F. McKanna, President.....West Warwick
Charles J. Smith, Secretary.....146 Westminister St., Providence
Francis A. Holland, Treasurer.....511 Cranston St., Providence
Date of next meeting: January, 1935.
Place of next meeting: Providence.

SOUTH CAROLINA

W. R. Craig, President.....Walhalla
T. C. Sparks, Secretary-Treasurer.....Medical Building, Columbia
Date of next meeting:
Place of next meeting: Aiken.

SOUTH DAKOTA

H. G. Tarbell, President.....Watertown
E. W. Elmen, Secretary.....611 Citizens Bldg., Sioux Falls
J. W. King, Treasurer.....Aberdeen
Date of next meeting: May 13-14, 1935.
Place of next meeting: Huron.

TENNESSEE

J. J. Vaughn, President.....Medical Arts Bldg., Nashville
E. J. Justis, Secretary-Treasurer.....708 Exchange Bldg., Memphis
Date of next meeting: May 14-16, 1935.
Place of next meeting: Nashville.

TEXAS

J. F. Clark, President.....San Jacinto Life Bldg., Beaumont
J. G. Fife, Secretary-Treasurer.....Medical Arts Bldg., Dallas
Date of next meeting: April 15-18, 1935.
Place of next meeting: Waco.

UTAH

J. H. Davis, President.....First Nat'l Bank Bldg., Salt Lake City
William Wood, President Elect.....First Nat'l Bank Bldg., Salt Lake City
E. W. Lambert, Secretary-Treasurer.....Judge Building, Salt Lake City
Date of next meeting:
Place of next meeting:

VERMONT

Howard F. Killary, President.....Burlington
H. E. Spear, Secretary.....Swanton
Thomas A. Norton, Treasurer.....Rutland
Date of next meeting: May 15-17, 1935.
Place of next meeting: Burlington.

VIRGINIA

J. T. Ashton, President.....108 N. Washington St., Alexandria
N. F. Muir, President Elect.....Shenandoah Life Bldg., Roanoke
A. M. Wash, Secretary-Treasurer.....Medical Arts Bldg., Richmond
Date of next meeting: July 1-3, 1935.
Place of next meeting: Hot Springs.

WASHINGTON

G. Burwell Mann, President.....609 Medical Dental Bldg., Spokane
A. W. Jeffery, Secretary-Treasurer.....533 Medical Dental Bldg., Seattle
Date of next meeting: May, 1935.
Place of next meeting: Spokane.

WEST VIRGINIA

H. S. Barr, President.....Charleston
C. G. Anderson, Secretary.....Mount Hope
John S. Stone, Treasurer.....Clarksburg
Date of next meeting: May 20-22, 1935.
Place of next meeting: Parkersburg.

WISCONSIN

George E. Morgan, President.....2039 Prospect Avenue, N. Milwaukee
E. E. Parkinson, Secretary.....104 King Street, Madison
O. M. Dresen, Treasurer.....735 North Water St., Milwaukee
Date of next meeting: April 16-18, 1935.
Place of next meeting: Milwaukee.

WYOMING

P. M. Cunningham, President.....Cheyenne
E. C. Andrew, Secretary.....Cheyenne
Peter Appel, Jr., Treasurer.....Cheyenne
Date of next meeting: July, 1935.
Place of next meeting: Cheyenne.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, New Orleans, La., November 4-8.

American Dental Society of Europe, London, July 31-August 3.

American Society of Orthodontists, New York City, April 30-May 3.

Belgian National Dental Congress, Brussels, August.

Dallas (Texas) Midwinter Dental Clinic, February 4-6.

Eastern Association of Graduates of Angle School of Orthodontia, New York City, January 28.

Five State Postgraduate Clinic, Washington, D. C., March 18-20.

Great Lakes Association of Orthodontists, Detroit, Mich., January 28-29.

International Dental Congress, Vienna, Aug. 2-9, 1936.

Midwinter Clinic of the Chicago Dental Society, February 18-21.

National Board of Dental Examiners, January 11-12; May 24-25.

New York State Dental Hygienists Association, Saranac, June 12-15.

Rocky Mountain Midwinter Clinic, Denver, January 9-12.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

STATE SOCIETIES

February

Minnesota, at Minneapolis (26-28)

April

Mississippi, at Jackson (22-24)

New Jersey, at Atlantic City (24-26)

Wisconsin, at Milwaukee (16-18)

May

Georgia, at Atlanta (13-15)

Illinois, at Quincy (14-16)

June

Maine, at Augusta (21-22)

New York, at Upper Saranac (12-15)

North Carolina, at Blowing Rock (17-19)

STATE BOARD OF DENTAL EXAMINERS

Delaware, at Wilmington, January 23-24. W. S. P. Combs, Middleton, Secretary.

New Jersey, at Trenton, June 24-29. J. C. Forsyth, 148 W. State St., Trenton, Secretary.

North Dakota, at Fargo, January 8-11. W. E. Cole, Bismarck, Secretary.

GEORGIA DENTAL ASSOCIATION

The sixty-seventh annual meeting of the Georgia Dental Association will be held at the Ansley Hotel, Atlanta, May 13-15.

R. H. MURPHY, *Secretary,*
920 Georgia Casualty Bldg.,
Macon.

WISCONSIN STATE DENTAL SOCIETY

The next meeting of the Wisconsin State Dental Society will be held at the Schroeder Hotel, Milwaukee, April 16-18.

E. E. PARKINSON, *Secretary,*
104 King St.,
Madison.

NORTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the North Dakota State Board of Dental Examiners will be held January 8-11 at the Gardner Hotel, Fargo. Applications, with necessary fee, must be in the hands of the secretary at least ten days prior to the date of examination. Address all communications to

W. E. COLE, *Secretary,*
Bismarck.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY

The next meeting of the American Society for the Advancement of General Anesthesia in Dentistry will be held March 25 at the Fraternity Club, 22 East Thirty-Eighth Street, New York City. Essayist, Paul M. Wood, New York City; subject, "Complete Study of Principles and Methods Used in the Handling of All Emergencies That Arise Under General Anesthesia." Informal dinner at 7 p.m.; scientific session, 8:30.

HARRY J. FIELD, *Secretary*,
130 Market St.,
Newark, N. J.

AMERICAN SOCIETY OF ORTHODONTISTS

The thirty-third annual meeting of the American Society of Orthodontists will be held in New York City, April 30-May 3, at the Waldorf-Astoria.

CLAUDE R. WOOD, *Secretary*,
Medical Arts Bldg.,
Knoxville, Tenn.

MAINE DENTAL SOCIETY

The seventieth anniversary meeting of the Maine Dental Society will be held at the State House, Augusta, June 21-22.

GEORGE A. PHILLIPS, *Secretary*,
31 Central St.,
Bangor.

NEW JERSEY STATE DENTAL SOCIETY

The sixty-fifth annual meeting of the New Jersey State Dental Society will be held at the Ambassador Hotel, Atlantic City, April 24-26.

F. K. HEAZELTON, *Secretary*,
223 E. Hanover St.,
Trenton, N. J.

NORTH CAROLINA DENTAL SOCIETY

The sixty-first annual meeting of the North Carolina Dental Society will be held at the Mayview Manor, Blowing Rock, June 17-19.

D. L. PRIDGEN, *Secretary*,
Fayetteville.

NEW JERSEY STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY

The State Board of Registration and Examination in Dentistry of New Jersey will hold its annual examinations in Trenton, commencing June 24 and continuing for five days thereafter. On application to the secretary, a copy of the requirements and rules, instruction sheet and preliminary application blank will be sent. Any person desiring to apply as a candidate must file the preliminary application, together with the examination fee of $25 on or before March 15 for the succeeding June examinations or before September 1 for the succeeding December examinations.

JOHN C. FORSYTH, *Secretary*,
148 W. State St.,
Trenton.

EASTERN ASSOCIATION OF GRADUATES OF THE ANGLE SCHOOL OF ORTHODONTIA

A regular meeting of the Eastern Association of Graduates of the Angle School of Orthodontia will be held January 28, at the Hotel Vanderbilt, New York City.

E. SANTLEY BUTLER, *Secretary*,
576 Fifth Avenue,
New York City.

DALLAS MIDWINTER DENTAL CLINIC

The ninth Dallas Midwinter Dental Clinic will be held February 4-6 at Baylor University School of Dentistry. Clinicians: George B. Winter, St. Louis; Ralph C. Cooley, Houston; R. O. Schlosser, Chicago, and Charles A. Sweet, Oakland, Calif. For further information, address

JOHN R. SWANSON,
Medical Arts Bldg.,
Dallas, Texas.

NINTH INTERNATIONAL DENTAL CONGRESS

The Ninth International Dental Congress of the Fédération Dentaire Internationale will be held in Vienna, Aug. 2-9, 1936.

BALINT ORBAN, *Secretary*,
Vienna IX,
Wahringerstrasse 25 A,
Austria.

ARE YOU PREPARED TO DISCUSS SOCIALIZED DENTISTRY AND MEDICINE?

THE LIBRARY BUREAU

of the

American Dental Association
212 East Superior Street
Chicago, Illinois

can supply books or package libraries as follows:

BOOKS*

Asgis, A. J.	An outline of dental socio-economics. New York, Allied Dental Council, Inc., 1934. $1.00.
Committee on Costs of Medical Care	Medical care for the American people. (Final report) Chicago, University of Chicago Press, 1932. $1.50.
Davis, M. M.	Paying your sickness bills. Chicago, University of Chicago Press, 1931. $2.50.
	Economic security. New York, American Association for Social Security, 1934. $1.75.
Lee, R. I., & Jones, L. W.	Fundamentals of good medical care. Chicago, University of Chicago Press, 1933. $2.50.
Leuck, Miriam S.	Further study of dental clinics in the United States. Chicago, University of Chicago Press, 1932. $1.50.
Leuck, Miriam S.	Study of dental clinics in the United States: 1930. Chicago, University of Chicago Press, 1932. $1.00.
Leven, Maurice, & Beck, Dorothy F.	Practice of dentistry and the incomes of dentists in twenty states: 1929. Chicago, University of Chicago Press, 1932. $2.00.
Oschner, E. H.	Social insurance and economic security. Boston, Mass., Bruce Humphries, 1934. $2.50.
Phelps, Edith M.	Socialization of medicine. New York, H. W. Wilson Co., 1930. $0.90.
Rubinow, I. M.	Quest for security. New York, Holt, 1934. $3.50.
Simons, A. M., & Sinai, Nathan	Way of health insurance. Chicago, University of Chicago Press, 1932. $2.00.
Williams, Pierce, & Chamberlain, Isabel	Purchase of medical care through fixed periodic payment. New York, National Bureau Economic Research, 1932. $3.00.
Wolfenden, H. H.	Real meaning of social insurance. Toronto, Macmillan Company of Canada Ltd., 1932. $2.00.

PACKAGE LIBRARIES†

Dental economics.
"Panel" dentistry.
Social and economic phases of dentistry and other health services.
Status of dentistry in our social and economic system.

---

*Books may be *borrowed* by members of the Association for a period of one week after date of receipt; and if not reserved for someone else, the period will be extended on request. A deposit of $2.00 for each volume to be sent at one time should accompany all requests for books. This will be refunded on return of books. If you wish to *purchase* books, indicate plainly which books you desire and enclose check with order.

†Each package library is composed of reprints, magazine clippings, pamphlets, monographs, etc. The packages are loaned to members of the Association for a period of one week after date of receipt. Unless the material is reserved for another borrower, an extension of time will be granted on request. *The rental fee for borrowing a package library is 50 cents.* This fee must accompany the request for a package library.

OFFICERS AND TRUSTEES OF THE AMERICAN DENTAL ASSOCIATION
1934-1935

PRESIDENT

Frank M. Casto.....1336 B. F. Keith Bldg., Cleveland, Ohio

PRESIDENT ELECT

George B. Winter.....Frisco Bldg., St. Louis, Mo.

VICE PRESIDENTS

Max E. Ernst.....1252 Lowry Bldg., St. Paul, Minn.
B. F. Thielen.....Paris, Texas
Frederick H. Lum, Jr.....151 Main St., Chatham, N. J.

SECRETARY

Harry B. Pinney.....212 E. Superior St., Chicago, Ill.

TREASURER

R. H. Volland.....First Capitol Nat'l Bank Bldg., Iowa City, Iowa

BOARD OF TRUSTEES

Frank M. Casto, President Ex-Officio...1336 B. F. Keith Bldg., Cleveland, Ohio
George B. Winter, President Elect, Ex-Officio.....Frisco Bldg., St. Louis, Mo.
Harry B. Pinney, Secretary, Ex-Officio.....212 E. Superior St., Chicago, Ill.
R. H. Volland, Treasurer, Ex-Officio.....
.....First Capitol Nat'l Bank Bldg., Iowa City, Iowa
J. G. Hildebrand, '37.....Waterloo, Iowa
Albert R. Ross, '37.....Murdock Bldg., Lafayette, Ind.
Oren A. Oliver, '37.....Medical Arts Bldg., Nashville, Tenn.
Harvey J. Burkhart, '36.....Box 879, East Avenue P. O., Rochester, N. Y.
C. R. Lawrence, '36.....730 Bass Bldg., Enid, Okla.
Herbert C. Miller, '36.....E. 6th and Oregon Sts., Portland, Ore.
W. H. Robinson, '36.....American Bank Bldg., Oakland, Calif.
Harry Bear, '35.....410 Professional Bldg., Richmond, Va.
C. Willard Camalier, '35.....1726 Eye St., N. W., Washington, D. C.
Thomas L. Grisamore, '35.....29 E. Madison St., Chicago, Ill.
E. G. Meisel, '35.....121 University Place, Pittsburgh, Pa.
Marcus L. Ward, '35.....1308 Cambridge Road, Ann Arbor, Mich.
Philip E. Adams, '35.....106 Marlborough St., Boston, Mass.